SCIENTIFIC AMERICAN

A Weekly Review of Progress in

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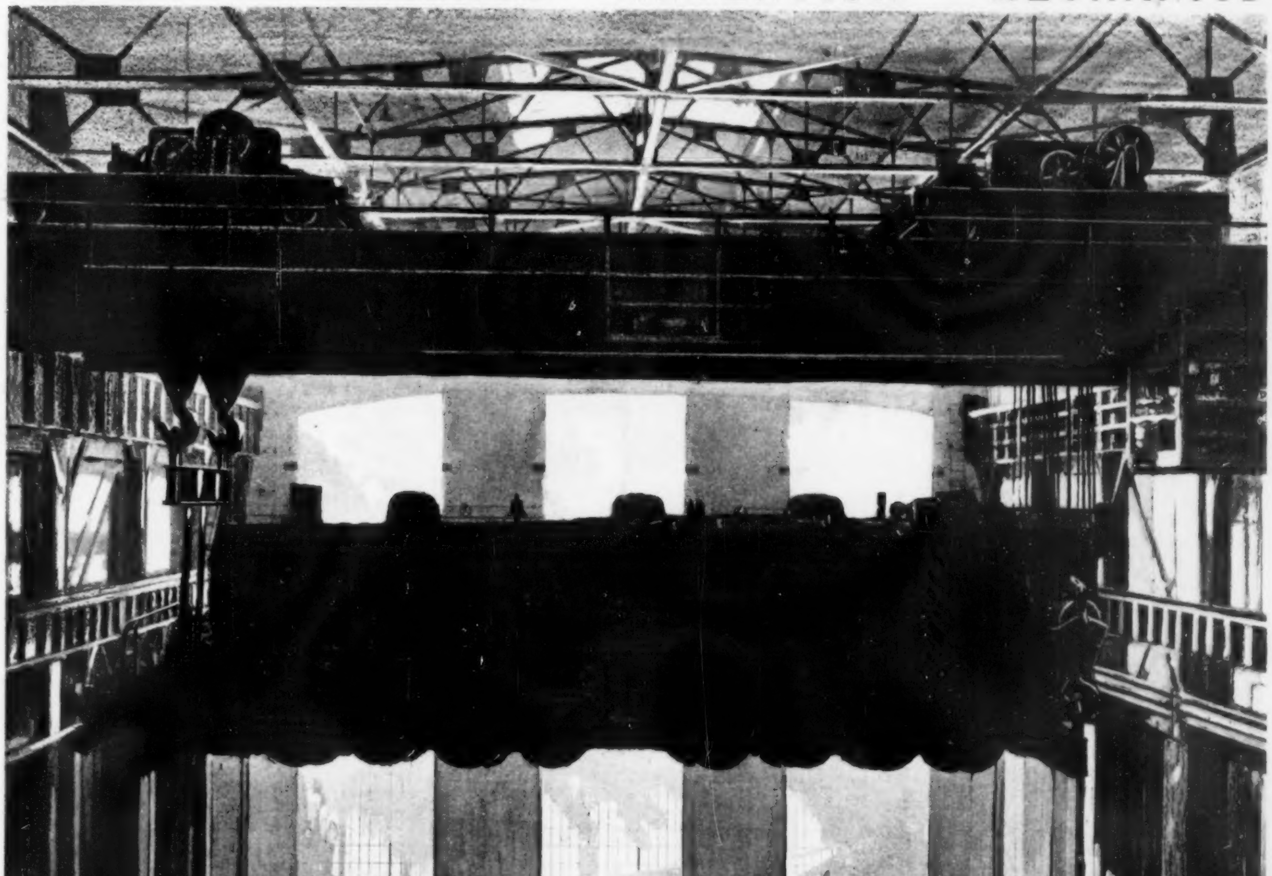

LIFTING A GIANT LOCOMOTIVE WITH AN ELECTRIC CRANE—[See page 620]

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Correct
AUTOMOBILE LUBRICATION

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Mobiloils

A grade for each type of motor

Gargoyle Mobiloils for engine lubrication are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil Arctic

The Chart below indicates the grade recommended by the Vacuum Oil Company's Board of Engineers. The recommendations cover all models of both passenger and commercial vehicles unless otherwise noted. If your car is not listed in this partial Chart, send for booklet "Correct Lubrication" which lists the correct grades for *all* cars.

AUTOMOBILES	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter*	Summer	Winter
Allen	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
Auburn (4 cyl.)							A	Arc	A	Arc.
Auburn (6 cyl.)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Auburn (6-38)					A	Arc	A	Arc		
" (6-39B)(Teetor-H)			A	Arc						
Autocar (2 cyl.)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
Briscoe	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
" (8 cyl.)							A	A		
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Cadillac (8 cyl.)	A	A	A	A	A	A	A	A	Arc	Arc.
Case	Arc	Arc	Arc	Arc	A	Arc	A	Arc	A	Arc.
Chalmers			A	A			Arc	Arc	Arc	Arc.
" (6-40)							A	Arc		
" (6-30)	A	A			A	A	A	A		
Chandler Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Chevrolet	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
" (8 cyl.)	A	A	A	A	A	A				
" (F.A.)	A	Arc	A	Arc						
Cole							Arc	Arc	Arc	Arc.
" (8 cyl.)	A	A	A	A	A	A	A	A	A	A
Cunningham									Arc	Arc.
" (8 cyl.)	A	A	A	A	A	A	A	A		
Dart	Arc	Arc	A	Arc	A	Arc	A	Arc	Arc	Arc.
" (Model C)					A	Arc	A	Arc	A	Arc.
" (2 and 3½ ton)	A	A	A	A						
Dodge Brothers	A	Arc	A	Arc	A	Arc	A	Arc	E	E
Dort	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
Federal	Arc	Arc	A	A	Arc	Arc	Arc	Arc	Arc	Arc.
" (Mod. S-X)			A	A	A	A				
Federal (special)			Arc	Arc						
Fiat			B	A	B	A	B	A	B	A
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	A
Grant	A	Arc	A	Arc	A	Arc	A	Arc	Arc	Arc.
" Com'l	Arc	Arc								
" " (Model 12)	A	Arc								
Haynes	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
" (12 cyl.)	A	A	A	A	A	A	A	A		
Hudson							Arc	Arc	Arc	Arc.
" Super Six	A	Arc	A	Arc	A	Arc	A	A		
Hupmobile	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Kelly Springfield	A	A	A	A	A	A	A	A	A	A
King									A	Arc.
" (8 cyl.)	A	A	A	A	A	A	A	A	Arc	Arc.
" Commercial			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Kissel Kar	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
" " (Model 48)							A	A	A	A
" " (12 cyl.)			A	A	A	A				
Lexington	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Lippard Stewart			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
" " (Mod. M)					A	Arc	A	Arc		
" " (Mod. MW)					A	Arc				
Locomobile	A	E	A	E	E	E	E	E	E	E
McFarlan			A	Arc	A	Arc	A	A	A	Arc.
McLaughlin	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
McLaughlin (Mod. E63)	A	A	A	A						
Madison			A	Arc	A	Arc	A	Arc	A	Arc.
" (8 cyl.)					A	A	A	A		
Marmon	A	A	A	A	A	A	A	A	A	Arc.
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Mercer	A	A	A	A	A	A	A	A	A	Arc.
" (22-70)									Arc	Arc.
Mitchell	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
" (8 cyl.)							A	A		
Moline-Knight	B	A	B	A	A	A	A	A	A	A
Monroe			A	Arc	A	Arc	E	E	A	Arc.
" (Mod. M4)			A	A	A	A				
" (Mod. S)	A	A								
Moon			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Nash	A	Arc	A	Arc						
" (Mod. 671)			A	A						
" (Quad)	A	A	A	A						
National	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	Arc.
" (12 cyl.)	A	A	A	A	A	A	A	A		
Nelson	A	A	A	A	A	A				
Oakland	A	A	A	A	Arc	Arc	Arc	Arc	Arc	Arc.
" (8 cyl.)							A	A		
Oldsmobile (4 cyl.)	A	Arc					Arc	Arc	Arc	Arc
" (6 cyl.)	A	A	A	A	Arc	Arc			Arc	Arc
" (8 cyl.)	A	A	A	A	A	A	A	A		
Overland	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.	Arc
Packard									A	Arc
" (12 cyl.)	A	A	A	A	A	A	A	A		
" Commercial	A	A	A	A	A	A	A	A	A	A
Paige (4 cyl.)									A	Arc
" (6 cyl.)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (6-36)							A	Arc	A	Arc
" (6-38-39)					A	Arc				
" (6-40)	A	Arc	A	Arc						
Paige (Com'l)	Arc	Arc	Arc	Arc						
Paterson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Peerless			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl.)	A	A	A	A	A	A	A	A		
Pierce Arrow	A	A	A	A	A	A	A	A	Arc	Arc
" " Com'l	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	A	A	Arc	A	Arc
Regal	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl.)							A	A	Arc	Arc
Renault (French)							A	Arc	A	Arc
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Riker	A	E	A	E	E	E				
Saxon	E	E	E	E	E	E	E	E	E	E
Selden	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
" (1½ ton)					A	Arc				
Simplex Crane			A	A	A	A	A	A	Arc	Arc
Stearns-Knight	B	A	B	A	A	A	B	A	B	A
Studebaker	A	Arc	A	Arc	A	Arc	A	Arc	Arc	Arc.
Stutz	A	A	A	A	A	A	A	A	A	A
Velie (4 cyl.)									A	Arc.
" (6 cyl.)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
" (2 & 3½ ton)	Arc	Arc	Arc	Arc						
" (¾ ton)	A	Arc	A	Arc						
Westcott	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
White	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
" (Sixteen Valve)	A	A	A	A	A	A				
White (3 ton)	A	A	Arc	Arc						
Willys-Knight	B	A	B	A	A	A	B	A	B	A
Willys Six	Arc	Arc	Arc	Arc	Arc	Arc				
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.

AMERICA'S OPPORTUNITY

The part played by Scientific Lubrication in the Nation's Agriculture

ONLY one half of America's total farm area is improved and bearing crops. Our average yield of wheat per acre is 14 bushels. By intensive farming Germany grows 28 per acre, England 32.

We can double the area of our cultivated land and quadruple our agricultural production.

How?

The farmer turns to his tractor, his motor-truck and his automobile to hasten larger yield and lessen waste.

His tractor plows a better seed bed. It works in torrid weather which horses cannot stand. It harvests. It does numerous odd jobs. It fills silos, it pumps, it threshes.

His motor truck hastens the farmer's crops to market. Waste is eliminated. The incentive is given to plant for bigger yield.

The farmer's automobile has wiped out the comparative isolation of his life. The neighbor two miles away may now be reached in a few minutes.

* * *

SCIENTIFIC LUBRICATION is playing its part on the farm.

It is significant that great numbers of farmers use nothing but Gargoyle Mobiloils for their automotive equipment. Almost every tractor manufacturer uses only Gargoyle Mobiloils in state and national demonstrations. The farmer's day of larger yield is just ahead. The work must go on.

GARGOYLE

Mobiloils

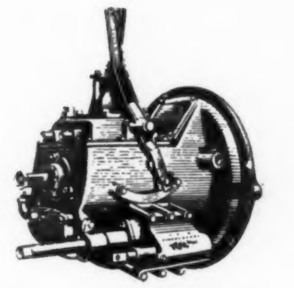
A grade for each type of motor

VACUUM OIL COMPANY *Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.* NEW YORK, U.S.A.

GMC

General Motors Trucks

—in Milling Delivery



Power from the GMC Motor may be applied for other purposes than driving the vehicle, through the Power Take-off. In raising telephone poles, moving safes, and in other auxiliary operations, the Power Take-off is thrown into gear through a special lever from the driver's seat

FIVE GMC Trucks are handling all deliveries of E-Z-Bake Flour within a radius of fourteen miles for the Acme-Evans Company, of Indianapolis.

Eight hours a day these sturdy trucks are speeding over city pavements and rutty country roads, carrying the Acme-Evans product to the little wayside grocery, the big wholesale house and the popular bakery on the avenue.

Regular, train-like schedules characterize the delivery of E-Z-Bake Flour, and so dependable are the route schedules that special deliveries are unknown. This fact means economy through GMC Trucks.

During the three years these GMC Trucks have been in operation their performance has been highly satisfactory, according to the written testimony of Mr. R. C. Crosswhite, the company's sales manager.

The trucks are running like new and several more years of service are expected from them.

In hundreds of other lines of business GMC Trucks are covering delivery routes with unfailing regularity.

GMC Trucks are made by the exclusive truck-making unit of the General Motors Corporation and backed by this strongest of automotive organizations.

GENERAL MOTORS TRUCK COMPANY

One of the Units of the General Motors Corporation

PONTIAC, MICHIGAN, U. S. A.

Branches and Distributors in Principal Cities

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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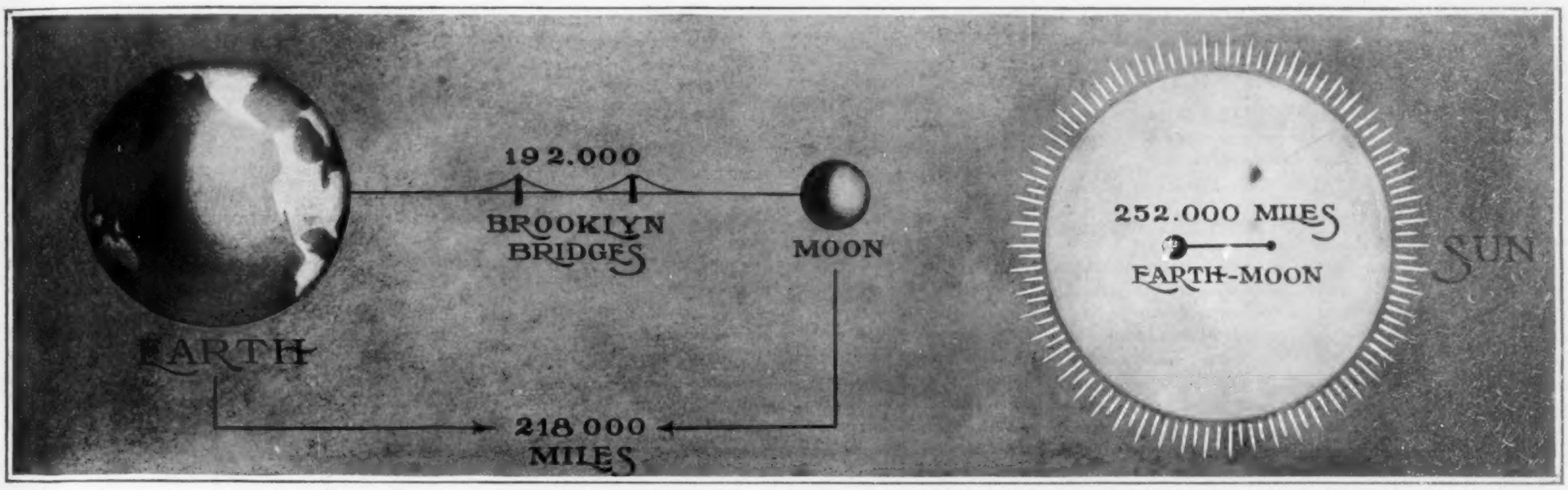

When the moon is at her closest, it would take nearly 200,000 Brooklyn Bridges to span the gap between her and the earth; yet so insignificant is this distance, astronomically, that at the time of the moon's greatest recession the entire moon-earth system would occupy less than a third of the sun's diameter

How Far Away is the Moon?

EVERYBODY—at least everybody who is at all interested in the subject, and doubtless a good many people who are not particularly interested in it—everybody, we say, knows that the distance from the earth to the moon is in round numbers 218,000 miles when the moon is closest, and 252,000 miles when she is farthest away. But numbers as large as this have little meaning of themselves. When we talk about one mile or two miles we have a pretty clear notion of how far such a distance is; when we get to dealing with hundreds of miles, or even with a moderate number of thousands, we can perhaps visualize such distances fairly well; but a quarter of a million is really a little too much.

If we only had some sort of a convenient yardstick to apply to such distances, it might help us a good deal to get them in our eyes and in our minds. As one part of the illustration above indicates, if the Brooklyn Bridge were to be duplicated 192,000 times in a row, the distance to the moon at her nearest would just be spanned. Or if the existing Brooklyn Bridge were to be expanded so that every inch of its length would become three miles and a half, we should again have a structure that would reach to the moon.

It has often enough been pointed out that an express train running 60 miles per hour for 24 hours per day would require no less than five months to reach the moon. This comparison, of course, dates back to a time when the 60-mile train was the last word in earthly speed. If we bring it up to date by substituting the 150-mile airplane we may cut to a mere sixty days the time for our hypothetical journey through space to our nearest neighbor. A projectile traveling at a uniform rate of one mile per second—a speed which was approached closely enough by the German 70-mile gun to make it appear quite certain that it is practical from the artillerist's viewpoint—would reach the moon in from 2½ to three days, according to the position of our satellite with reference to the earth.

This makes the quarter-million miles or thereabouts from the earth to the moon look quite respectable to our eyes, accustomed only to the distances which we can scale off here on the earth. But really, this distance, astronomically speaking, is just about as near to nothing as one could conveniently get. When we take a celestial body of decent size, such as the sun, we see this very quickly; for far from requiring that the diameter of such a body be multiplied by 30 to equal the distance which we are discussing, we actually find that the distance requires multiplication in order to equal the diameter of the sun! That is to say, the sun, which is by no means a large star as stars go, could easily contain with its boundaries the entire earth and moon and the distance between them. In fact, though our drawing is not got up so as to exhibit that feature of the case particularly, three systems like that consisting of earth and moon could be strung out in a row through the center of the sun, without coming within fifty thousand miles of his surface on either side!

The New Scientific American Monthly

ONE of the most important results of the great war we have just been through has been a widespread interest in science and a greater appreciation of scientific research on the part of manufacturers and business men. It has come to be realized that no man can afford to confine his reading to literature dealing solely with his own field of technology. He must keep up with the progress in other fields as well, because there is such a close interrelationship between various branches of science that he is liable to miss something of utmost importance to his interests if he reads only his own trade or class papers.

Unfortunately the literature of modern applied science is so vast and is growing so rapidly that the busy man cannot attempt to keep pace with it. And even if he could spare the time to read all the technical journals, he would find them written in a language that only an expert could understand. There is a real need at the present moment for a periodical that will give a review of current technical literature—something more than a mere index—which will keep the general reader posted on the more important advances in all fields of applied science. To fill this need we are going to broaden the scope of the SCIENTIFIC AMERICAN SUPPLEMENT, changing it in form and publishing it monthly instead of weekly. In its new form it will be known as the SCIENTIFIC AMERICAN MONTHLY. The first issue will be published on the first of January, 1920. It will be composed of ninety-six pages of reading matter as against sixteen of the present weekly edition and the new page size will be nine by twelve inches, a form more suitable for monthly publication than that in which the SUPPLEMENT at present appears.

A most useful department of the SCIENTIFIC AMERICAN MONTHLY will be that devoted to the work of the National Research Council. A section of the SCIENTIFIC AMERICAN MONTHLY will be used as an official organ of that body to keep the public informed of the work the Council is doing in organizing scientific research and introducing it into our industries. The aim of the Council is to make science as important an adjunct of manufacture in this country as it has been in Germany.

To further this laudable work we have also arranged with the United States Bureau of Standards to edit a Department in which the splendid research work of this branch of our Government service will be summarized and specially prepared for readers of the SCIENTIFIC AMERICAN MONTHLY. The National Academy of Sciences will also furnish notes on the progress made by American men of science.

The American Institute of Mechanical Engineers will supply carefully selected summaries of the more important articles on mechanical engineering, appearing in the current periodicals. Arrangements for similar material are being made with other national technical societies. The fields of Electrical Engineering, Chemistry and Metallurgy will be covered in separate departments. In each case the source of the article will be given so that the reader may study the complete original text if he so desires. This feature of the journal will be invaluable to a wide circle of readers, and particularly to progressive manufacturers.

The SCIENTIFIC AMERICAN MONTHLY will continue to publish the more important announcements of distinguished technologists, appearing in foreign as well as in domestic publications, thereby reflecting the most advanced thought in science and technology throughout the world. In its columns will be found the complete text of significant European articles, furnishing often the only English translation of these papers that is obtainable.

The SCIENTIFIC AMERICAN MONTHLY, although a separate journal, will be closely allied to the regular weekly SCIENTIFIC AMERICAN and will supplement the work in this journal. Many important topics which, owing to the limitations of space, can be referred to only briefly in our pages, will be published in full in the SCIENTIFIC AMERICAN MONTHLY, thus making the new journal a most important if not absolutely indispensable adjunct to the SCIENTIFIC AMERICAN.

SCIENTIFIC AMERICAN

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Peace League and Disarmament

IT is a matter of record that, following the armistice, these United States, as represented by their President, went to Europe to coöperate with their allies in arranging the terms of peace, and also to find some better means of settling future international disputes than by the ordeal of battle. Prominent among the provisions of the Treaty was one for the mutual reduction of armaments, and notably of the huge fleets which the threat of an aggressive German naval policy had called into being.

It will be remembered that, during this same period, the Secretary of the Navy was urging the authorization by Congress of the construction of a fleet of some one hundred and fifty vessels, which was to be an exact duplicate of the powerful fleet we then had under construction. The cost of the additional fleet would have been about one billion dollars.

Our readers will remember that we drew attention to the flagrant inconsistency involved in our Naval Secretary's urging the United States to make an enormous increase in its own naval forces, at the very time when our President was entering the Peace Conference with a request that our European Allies make a sweeping reduction in their sea power. In the midst of the general bewilderment as to what it all meant, there was one clear-eyed American, for whom the enigma was no enigma. A few days before his death, on December 27th to be exact, Theodore Roosevelt (would that this great American were with us in these shameful days!) wrote a letter, which now lies before us, in which he said: "The proposal of Mr. Wilson to build a navy in rivalry to Great Britain, if made in good faith, would merely be to build a spite navy. But, if it was not made in good faith, it was made in order to bluff Lloyd George and the Englishmen, and force them to assent to some of President Wilson's Peace League and disarmament plans."

Be all that as it may, the sequence of events is illuminating; and it should provide all Americans who are jealous of the prestige and honor of their country with food for serious reflection. Europe, as we all know, listened to our President; accepted, in its essential principles, his plan; and, in so doing, swept aside practices and policies of their own which had the sanction of centuries behind them. And, as for naval retrenchment, they did not even wait for the conference. The signatures to the armistice were scarcely dry before France and Italy made semi-official announcement that they would undertake or prosecute no battleship construction. As for Great Britain, she put in the pruning knife with a ruthless hand, stopping all battleship construction, and scrapping no less than 156 warships, including many that were on the ways and partially built, three of them being sisters to the 42,000-ton "Hood." This wholesale disarmament included the scrapping of every one of her pre-dreadnought battleships, some thirty in all, the latest of which are comparable to our own "Connecticut" and "Louisiana," and all of her armored cruisers. And the end is not yet; for according to the latest advices, she has condemned her earlier battle-cruisers of the "Indomitable" class, mounting the 12-inch-gun. She has cut her personnel from 450,000 to 100,000 men, which is less than the total in our own Navy. And this, mark you, our allies have done on their own initiative, without waiting for us to put our own name to the Treaty of which we are the foster parent.

And what has been the response of the United States? What have we done in the matter of the Treaty and disarmament? As regards the Treaty, after months of embittered and rancorous debate, during which our European Allies have looked on in dumbfounded amazement, this child of ours has been officially crucified by the representatives of the great people who gave it birth. And it affords us poor consolation to know (since Europe does not know it) that the Senate, in all its history was never so unrepresentative of the will of the American people as when it did this totally unexpected and most outrageous thing.

As for what we are doing as our share in a disarmament of our own proposing, we cannot do better than quote from the recent report of the Secretary of the Navy: "With battleships in service equal to or superior to any now in commission and six huge battle-cruisers and twelve battleships under construction, a number of them larger than any now in commission, the Navy is pressing forward to greater things."

So while our allies are putting through in good faith a drastic reduction of their naval forces, our naval secretary, the great protagonist of disarmament, boasts that we are not only building eighteen battleships and battle-cruisers, but that the Navy is "pressing forward to even greater things."

As to the abandonment of the second three-year program, it was common gossip in the lobbies of Congress that the ships were never intended to be built. It was a paper fleet; and to call its abandonment, disarmament, is merely to juggle with words.

Many of these eighteen capital ships to which the Secretary refers are, of course, so far advanced that, as in the case of the British "Hood," it would be economy to push them through to completion. Thus, the six battleships of the "Tennessee" type should be finished. The plans of the six 35-knot battle-cruisers are being redrawn. A comparatively slight increase in their size and a reduction in their speed to 32 knots, would enable their armor plan to be made equal to that of the "Hood." If heavier armor were used and worked into the decks rather than on the sides, we should have a better design than the "Hood." We need these fast ships to round out our Navy; but as to the six 42,000-ton battleships upon which little or nothing has been done, it would be a gross waste of public moneys to commence their construction at the present time. If Great Britain should scrap her 12-inch-gun dreadnoughts, as seems likely, we shall be stronger in capital ships than she; and she has stated semi-officially that she will build no capital ships for five years to come.

To embark on the unnecessary construction of six huge ships, costing by the time they are completed a quarter of a billion dollars, will serve merely to arouse suspicion, accentuate the tragic collapse of international confidence due to our repudiation of the Treaty, and impose further burdens of taxation upon an already overburdened people.

The Nature of Things

DR. EINSTEIN has had his name in the papers very freely of late; and a great deal of information, together with an appreciable quantity of misinformation, has been laid before the public with reference to the revolution which he proposes to effect in our physical science. We plan to contribute our share to this exposition in due time. There is, however, one phase of the matter which has not been discussed at all, and that is the position which Einstein's work occupies as a phase of human thought.

There was a time when it was believed, as a result of centuries of experience, that the world was flat. This belief checked up with the known facts, and it could be used as the basis for a system of science which would account for things that had happened and that were to happen. It was entirely sufficient for the time in which it prevailed.

Then one day a man arose to point out that all the known facts were equally accounted for on the theory that the earth was a sphere. It was in order for his contemporaries to admit this, to say that so far as the facts in hand were concerned they could not tell whether the earth was flat or round—that new facts would have to be sought that would contradict one or the other hypothesis. Instead of this the world laughed and insisted that the earth could not be round because it was flat; that it could not be round because then the people would fall off the other side.

But the field of experimentation widened, and men were able to observe facts that had been hidden from them. Presently a man sailed west and arrived east; and it became clear that in spite of previously accepted "facts" to the contrary, the earth was really round. The previously accepted "facts" were then revised to fit the newly discovered truth; and finally a new system of science came into being, which accounted for all the old facts and all the new ones.

At intervals this sort of thing has been repeated. A Galileo shows that preconceived ideas with regard to the heavens are wrong, and must be revised to accord with his newly promulgated principles. A Newton does the same for physics—and people unlearn the "fact" that motion has to be supported by continued application of force, substituting the new idea that it actually requires force to stop a moving body. A Harvey shows that the things which have been "known" for generations about the human body are not so. A Lyell and a Darwin force men to throw overboard the things they have always believed about the way in which the earth and its creatures came into being. Every science we possess has passed through one or more of these periods of readjustment to new facts.

Now we are apt to lose sight of the true significance of this. It is not alone our opinions that are altered; it is our fundamental concepts. *We get concepts wholly from our perceptions*, making them to fit those perceptions. Whenever a new vista is opened to our perceptions, we find facts that we never could have suspected from the restricted viewpoint. We must then actually alter our concepts to fit these new facts.

As a fair example, see what the acceptance of the earth's sphericity did to the idea represented by the word "down." With a flat earth, "down" is a single direction, the same throughout the universe; with a round earth, "down" becomes merely the direction leading toward the center of the particular heavenly body on which we happen to be located. It is so with every concept we have. No matter how intrinsic a part of nature and of our being a certain notion may seem, we can never know that new facts will not develop which will show it to be a mistaken one. Today we are merely confronted by a gigantic example of this sort of thing. Einstein tells us that when velocities are attained which have but just now come within the range of our close investigation, extraordinary things happen—things quite irreconcilable with our present concepts of time and space and mass and dimension. We are tempted to laugh at him, to tell him that the phenomena he suggests are absurd because they contradict these concepts. Nothing could be more rash than this.

When we consider the results which follow from physical velocities comparable with that of light, we must confess that here are conditions which have never before been carefully investigated. We must be quite as well prepared to have these conditions reveal some epoch-making fact as was Galileo when he turned the first telescope upon the skies. And if this fact requires that we discard present ideas of time and space and mass and dimension, we must be prepared to do so quite as thoroughly as our medieval fathers had to discard their notions of celestial "perfection" which demanded that there be but seven major heavenly bodies and that everything center about the earth as a common universal hub. We must be prepared to revise our concepts of these or any other fundamentals quite as severely as did the first philosopher who realized that "down" in London was not parallel to "down" in Bagdad or on Mars.

Aeronautical

Aerial Searchlights.—The British Air Ministry announces that, as an emergency measure to assist belated aircraft to locate their airdromes after dusk, it has been arranged for vertical searchlight beams to be projected from the official airdromes from about dusk till all service machines have arrived. From Hounslow airdrome there will be one beam, from Kenley two beams, and from Limpne three beams arranged in a triangle.

Anglo-Continental Air Service.—Air transport facilities are for the present confined to the London-Paris and London-Brussels services of the Airco and Handley-Page companies, the aircraft of the Messageries Ariennes, which fly in conjunction with the Handley-Page service, and the new route recently opened by the British Aerial Transport Company between London and Amsterdam. This is a weekly service, but another daily London-Amsterdam service is in contemplation for the very near future.

The Chinese Government, with a view to developing commercial aviation, has entered into a contract with the Vickers organization of England for the supply of a large number of Vickers-Vimy commercial airplanes. To meet the cost of the purchase of machines, construction of airdromes, repair depots, and administration, the Chinese Government is making an issue of approximately $9,000,000 in treasury notes, all of which sum is to be expended in the development of commercial aviation in that country.

Diplomas in Aeronautics.—The *Morning Post* announces that an institution, which is hoped to make the principal authoritative body for the technique of British commercial aviation, came into existence on September 11th in London, when a small body of aeronautical engineers organized the Institute of Aeronautical Engineers. This institute purposes to issue diplomas in the various branches of the industry after competitive examinations. Five grades of membership are proposed: (1) Open to pilot designers, engine designers, air-screw designers, and designers of aircraft that have flown; (2) open to aircraft designers and constructors of machines that need not necessarily have flown; (3) for pilots; (4) for learners; (5) allotted to honorary membership to which election will be made. Admission to the first three grades will be made by competitive examination.

A Tailless Airplane.—The *London Daily News* of recent date reports a statement made by Mr. J. A. Corry of Burley, Leeds, claiming that in points of stability and safety he has designed a machine which will be the safest and most flexible ever built and which can be run at speeds varying from 10 to 200 miles an hour. According to Mr. Corry, in the present-day machines the flexibility of the engine is mostly used to secure variation of speed, but in his machine no additional and violent stresses can take place even in the case of flattening out after a volplane; and as the machine has no tail, this could not be broken in climbing. He states that it would be absolutely impossible for his machine to corkscrew, overturn, or loop the loop. His design is said to involve a radical change in all known types of construction, but it still remains a true airplane, with planes of the kind now in use, and capable of flying with any of the aero engines or propellers already adopted.

An Ambitious Scheme.—A company has been formed in England for the purpose of operating a fleet of airships to various parts of the world. The syndicate desires to acquire ground near Southport, where it proposes to erect a tower 120 to 150 feet high to which airships may be moored, and an elevator will take the passengers up the tower and into the gondolas of the ships. The syndicate intends to have a fleet of non-rigid airships in commission next spring; the smaller will carry 32 passengers and crew and the larger 40 passengers and crew. The company also anticipates running some of the larger rigid airships now in course of construction. These will have a carrying capacity of 150 passengers and be able to travel to any part of the globe. It is proposed to use the smaller non-rigid airships to feed the larger ones and meet them at the principal centers. The cost per mile is put at about half the cost of a taxicab fare today, approximately about 18 cents per mile.

Science

Motion Pictures of Grain-Dust Explosions.—An energetic campaign against grain-dust explosions is now being conducted by the U. S. Department of Agriculture, in coöperation with the United States Grain Corporation. The urgency of this undertaking is shown by the fact that five severe explosions of this character have occurred in this country since last May, entailing a loss of 70 lives and destroying about $6,000,000 worth of property, besides large stores of grain. An experimental study of these explosions has been in progress for some time at the Pittsburgh station of the Bureau of Mines, where a photographer of the Department of Agriculture has obtained a number of motion pictures of the explosions. Some of these pictures have been taken under thrilling circumstances; in one case the operator, though working in a wooden shelter, was temporarily blinded and stunned by an explosion, which wrecked the apparatus used in the experiments and shook houses two or three miles away. The Government is preparing to use these motion pictures in connection with free lectures and demonstrations to be held in the principal towns of the country. Representatives of fire insurance interests will be invited to attend these meetings, as well as fire department officials, delegates from the grain interests and the general public.

An Acoustic Method of Marine Sounding has been described recently in the *Bulletin* de l'Institut Océanographique (Paris) by M. Marti. A small charge of explosive is set off under water alongside a moving vessel. A microphone, also submerged and attached to the vessel, records the sound of the explosion and its echo, due to reflection from the sea-bottom. From the interval of time between the original sound and the echo, the depth of water may be computed. Allowance must be made for the motion of the vessel, and also for the variation in the velocity of sound in sea-water due to temperature. The temperature correction involves some uncertainty, which is negligible for small depths but important for greater depths. In the latter case, however, as the horizontal distribution of temperaure is generally uniform over considerable areas, a few measurements with ordinary sounding apparatus would suffice to furnish the temperature corrections for numerous soundings by the acoustic method, and this method is therefore applicable for extensive hydrographic surveys. The idea involved in this method is not new, but apparently the experiments described by Marti represent the first practical application of the plan, and they proved highly successful. For rapid hydrographic surveys—*e. g.*, in laying out the route for a submarine cable—the acoustic method should be extremely useful.

Change of Zero of Thermometers.—In consequence of a "change of zero" with age, the readings of mercurial thermometers frequently become too high and those of spirit thermometers too low. The former effect, says Mr. F. J. W. Whipple, a well-known English authority, is due to a gradual shrinkage of the bulb, which forces the mercury up the stem. Various reasons have been suggested for the opposite effect in spirit thermometers; it has been thought that the thin film of liquid "wetting" the interior of the bore was sufficient to account for the errors found in tests, and that standing the thermometers with the bulb downward for a long time would always get rid of the discrepancies (as it certainly does in some cases). The vapor of the spirit has been supposed to enter into chemical combination with the glass or to make its way through it by way of invisible cracks. Mr. Whipple believes there is a simpler explanation. Mercury thermometers are sealed off when almost filled, so that they contain practically no air, and as the pressure inside the bulb is less than that outside the strain tends to make it shrink. Spirit thermometers, on the other hand, are sealed with the bulbs in a freezing mixture, so that they may contain as much air as possible, a condition which is said to reduce the trouble due to evaporation. Consequently such thermometers have high pressure inside the bulbs as compared with the pressure outside, and hence there must be a tendency of the bulbs to expand, so that the readings become too low and positive corrections are required.

Engineering

Motor Transport in China.—A development company located at Lungkow, Shantung Province, China, realizing the hopelessness of railway communication with Weihsien, due to present political and economic conditions, has planned to purchase 50 American motor trucks with a view to hauling the vast quantities of export produce and products to Lungkow for shipment abroad. This plan involves the coöperation of the Peking authorities in road repairing and construction from Lungkow to Weihsien. The introduction of a motor-truck transportation system will revolutionize the export trade of north central Shantung Province and will make Lungkow a serious competitor with Chefoo for the import and export trade of this region.

Canalization of the Rhone.—A bill for the canalization of the Rhone and the employment of water power was introduced in the French Chamber of Deputies recently. The cost of the scheme is estimated at about $482,500,000 and the total power to be obtained will not be less than the equivalent obtained from 5,000,000 tons of coal, or one-fifth the coal production of France for 1918. Among the proposed features of this improvement are locks which will be at least 262 feet long and 30 feet wide, admitting barges of 600 tons; six generating stations at the five dams to be erected, developing a total of 206,000 horse-power; loop canals 270 feet broad at the level and 10 feet deep; and a system of irrigation that will serve more than 617,760 acres.

Shipping and Engineering Exhibition at London.—The primary object sought by the promoters of the shipping, engineering, and machinery exhibition recently held at Olympia, London, England, was to take advantage of the great interest which had been aroused in the naval, shipping, and general engineering industries and to give the public an opportunity of seeing the extent to which new inventions have been produced, despite the setback occasioned by the war. Hence this exhibition has made an appeal to a wider public than that which would be directly concerned with shipping construction and the building of industrial machinery, or with the latest mechanical devices. The exhibit represented the advance which Great Britain and other countries have made, largely during the period of the war, in many branches of scientific knowledge and attainment in matters directly connected with engineering, although not confined to these departments of industry.

Reconstruction of the Belgian Railroads.—With the rapid revival of Belgian industry and trade the necessity for additional railway facilities becomes more pressing. While there has been a steady improvement since the armistice, the shortage of rolling stock is still acute, and it will necessarily be some time before normal conditions can be restored. At the time of the armistice, Germany had taken away the greater part of the rolling stock, and the restoration made under the terms of the peace treaty has not been sufficient to restore the railways to their prewar condition. Furthermore, the carriages, freight cars and locomotives returned by the Germans were usually found to be in bad condition, and extensive repairs were necessary before they could be utilized. Heavy purchases of freight cars have been made recently in Great Britain, and the pressing need for locomotives has been partly met by orders for 375 placed in the United States, for 125 in England, and for 175 within the country. It is expected that the British locomotives will be available immediately, as part of the stock used in France is to be turned over to Belgium, and it is hoped that early delivery of the material ordered from the United States will be possible. At the time of the armistice 932 miles of the Belgian railways had been destroyed and practically all has been replaced—a remarkable record, considering the difficulties to be overcome. Resumption of railway traffic has been greatly impeded because of the destruction of various bridges and embankments, but temporary replacement at least has now been effected in all cases. On the important line from Ostend to Brussels, for instance, the great viaduct, 300 feet in length and 60 feet in width, which was entirely wrecked, has been rebuilt, and traffic is practically normal.

A Solid Fuel in Liquid Form

The Strange Colloidal Combination of Oil and Coal That May Support the Industry of the Future

By Robert G. Skerrett

OUR troubles with fuel at the present moment are mainly the difficulty of getting it at all. But at all times the fuel situation is unsatisfactory, as regards both costs and results. Also there is the problem to be met of choosing between solid and liquid fuels. Fuel engineers are today engaged in a line of research which promises to discharge us from our fuel ills. It is found that solid and liquid fuels can be combined in a colloidal form which possesses many inherent advantages, and which only needs complete working out to take a place at the head of the list of fuels. If such working out can be effected, the advantages will be many and great, as Mr. Skerrett makes clear in discussing their nature and magnitude.

PROBABLY no fact stands out today more conspicuously in the realm of power production than the part played by petroleum and its derivatives. In an increasing number of departments of industrial life liquid fuels are steadily encroaching upon the preserves heretofore claimed by coal and, what is even more to the point, are solving motive problems quite beyond the effective service of solid combustibles. Wherever possible, oil-burning steam plants are taking the place of coal-using installations.

But our domestic reserves of petroleum are being drawn upon at a disturbingly augmenting rate. The probable exhaustion is clearly indicated of the oil now underground here in the course of a couple of decades, unless means be devised by which higher percentages of the subterranean supplies can be raised to the surface. Again, it is declared that at the present trend of consumption substantially all of the known oil wells of the world will be drained in the course of a hundred years.

The logical conclusion is that coal will then come again into its own and that fuel oil will be something to talk about as a thing of the past. This potential situation might well disturb the engineering and the industrial worlds, for oil-burning installations have won their present positions by reason of practical advantages. Reversion to coal-burning would therefore mean a long step backward. How can this undesirable day be postponed?

Search for an answer to this question has revealed that coal and oil can be wedded, and the consequence of this union is "colloidal fuel," which, pound for pound, is susceptible of rendering much better service as a source of heat than either fuel oil or coal used independently. What is equally important, the composite fuel has all of the virtues of ordinary fuel oils and, further, the combination makes it feasible to utilize forms or grades of coal that are commonly considered little better than waste products. Finally, other solid carbonaceous materials can be united with a moderate percentage of fuel oil and fired in the furnaces of boilers that could not consume them effectually under normal conditions.

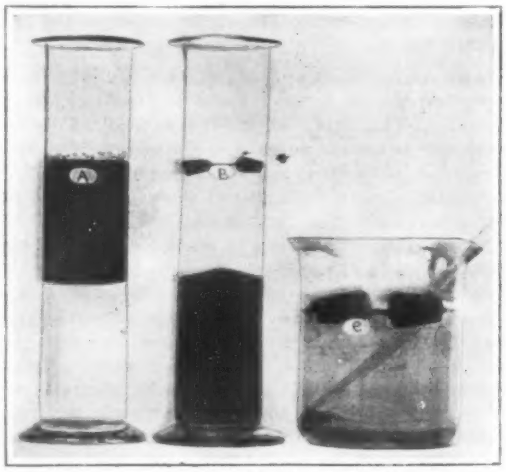
Heretofore, engineering data relating to boiler efficiencies have laid particular stress upon the theoretical heat values of the coal consumed, and steam raising has been gaged by the number of British thermal units in the quantity of coal used for the evaporation of specified volumes of water. As a matter of fact, these figures paid little heed to the amount of combustible remaining in the ashes after the coal had passed through the furnace. In common practice, however, the coal is burned more or less wastefully even where mechanical facilities do the stoking.

Where one hundred per cent efficiency would call for the consumption of coal containing only 33,479 BTU's per boiler horse-power per hour, as a matter of common experience, under capable management and with reasonably attentive firemen, it takes 56,000 BTU's in coal to develop this power. Remembering that good coal contains 14,000 BTU's per pound, simple arithmetic reveals how extremely wasteful is the burning of coal for the generation of steam.

The reason for this is easy to see. Aside from the wastage of combustible coal carried off in the ashes, the very way in which coal is ordinarily burned in lump form tends to increase ineffective use to a marked degree. Lump coal burns from the outside inward, and more or less slowly depending upon the size of the pieces in the first place, since contact with the needful oxygen is restricted. It is therefore easy to understand why powdered coal, where through certain contact with oxygen, almost instant combustion of earth particle is realized, is much more efficient than the forms of coal ordinarily employed. The same argument applies to atomized liquid fuels.

Where oil is burned in stationary engines the gain in efficiency is 20 per cent on the basis of thermal contents of the two fuels and nearly 100 per cent on a basis of their weight. In oil-burning ships, for equal bunker weight, the radius of action is increased 50 per cent, and for equal bunker space, 80 per cent. Oil furnishes up to 83 per cent of thermal efficiency as against 50 per cent for coal, and reduces the amount of labor by about 70 per cent. In railway service oil fuel was found to give still better results. One pound of oil, with 32.14 per cent more heat units than a pound of coal, actually developed 85 per cent greater caloric energy; while on express locomotives in England, it was found that one pound of oil did on the average the work of 2.2 pounds of coal.

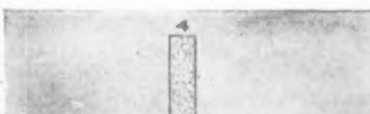
In summary, then, 1,000,000 BTU's in fluid will, on



Fuel oil floating on water. Colloidal fuel sealed under water. Colloidal fuel kept one year under water unaltered.

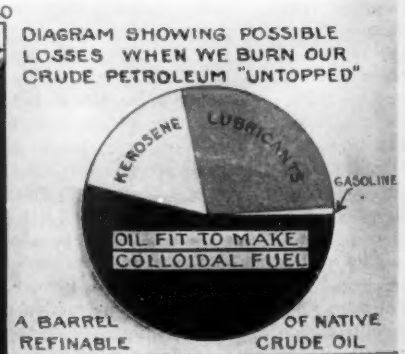
Experiments with fuel oil and colloidal fuel

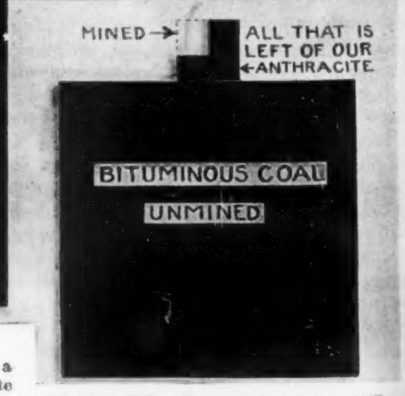
Some facts and figures concerning our fuel resources and what these mean in terms of colloidal fuels



A graphic showing of the relative bulk of several fuels that will yield the same heat values. 1, colloidal fuel; 2, fuel oil; 3, lump coal; 4, pulverized coal; 5, the uncombined oil and pulverized coal of the colloidal fuel; 6, similar proportions of oil and lump coal.

According to data issued by the U. S. Geological Survey we have remaining in our oil wells a total of 70 barrels of petroleum per capita, and we are now using up this oil at the rate of 3.4 barrels per capita yearly. A great deal of this oil is being consumed for power purposes without removing the higher grade oils from the petroleum. Every barrel of native crude oil thus burned "untopped" involves a grave economic waste. By first obtaining the kerosene, gasoline, and lubricant content of our domestic petroleum we would still have an abundance of the fluid base for colloidal fuels. Column 7, at the left, represents the volume of oil of equal weight with the first column of colloidal fuel.





We have still underground and potentially available the following amounts of coal based upon a per capita allowance for 100,000,000, population: Anthracite, 190 tons; bituminous, 15,000 tons; lignites, 20,000 tons. The latter can be worked into colloidal fuels.

Copyright, Keystone View Co.

Building English houses with concrete blocks—a feature of England's successful attempt to solve the housing problem

an average, equal 1,610,000 in hand-fired and 1,327,000 in mechanically-fired solid fuel. Now let us see what additional benefits are obtainable by combining coal and oil so that they can be dealt with and burned like oil.

To begin with, it is entirely feasible to prepare a colloidal fuel, amply liquid to meet the usual requirements, which will consist of 40 per cent by weight of coal and 59 per cent of oil—the other 1 per cent being the binder which holds the minute particles of solid carbon in suspension. This "fixateur" is for the most part combustible itself, and will exercise its strange power of nullifying the force of gravitation for periods of many months. As the coal percentage is further increased the composite fuel becomes progressively denser, ranging from a thin mixture to non-sticky pastes which, under proper pressure, can be pumped and atomized when their coal content is more than 65 per cent.

These colloidal fuels can cut down the size of our coal piles while increasing their thermal value. They achieve this by the fluidizing of a solid, so to speak: by saturating and surrounding with a film of oil every minute particle of the powdered carbon. Just picture what happens when these unctuous specks are atomized by pressure and blown into a fiery furnace. Instantly each infinitesimal bit of oil-soaked carbon is transformed into an incandescent gas, and all because every atom is in contact with sufficient oxygen to induce complete combustion.

As can be easily realized, colloidal fuels are of greater specific gravity than straight oil fuels, and because of this added density they carry, gallon for gallon, more heat units. They contain little moisture, are low in ash and sulphur, and hence are especially valuable in the metallurgical industries. They are vaporless and will not form an explosive mixture with air. Their flash point is above 200 degrees Fahrenheit, and they are immune to spontaneous combustion. According to their composition colloidal fuels will weigh from 8¾ to 11½ pounds per gallon. Because of this greater specific gravity, they sink in water, and therefore are self-quenching if spilled overboard in a blazing condition. Also, they may be fire-proofed by a water-seal of an inch or more in thickness, which will remain superposed upon the composite fuel. Similarly, flaming colloidal fuel can be quenched by covering its surface with water.

Charcoal, lignite, graphitic anthracite, coal screenings, culm, petroleum coke and other oil refinery wastes can be profitably utilized in colloidal fuels when pulverized, and the larger the percentage of solid carbon the greater the saving in fuel oil. Of course, the adoption of colloidal fuels in any part of the United States or any section of the world will depend upon the relative costs in each locality of the constituent oil and solid carbon. On an average, when the cost of 1,000,000 BTU's in colloidal fuel is lower than that of 1,610,000 BTU's in coal, hand-fired, or of 1,327,000 BTU's of coal, stoker-fired, then money can be saved by recourse to colloidal fuel.

In conclusion, it may be claimed for colloidal fuel that the quantity of liquid fuel available may be doubled without increasing the gross consumption of petroleum. To get the needful solid carbon to achieve this we have only to draw upon the waste or semi-waste materials already described. Thus both the coal and the oil industries are linked in a common cause of conservation and mutual benefit—the public gaining also in a multiplicity of directions.

Solving the Housing Problem with Concrete

WHILE not subjected to a ruthless enemy invasion and its accompanying wholesale destruction, Great Britain has nevertheless suffered severely from lack of housing facilities, just as most other countries of the world, whether belligerent or neutral in the recent war, are suffering. But let it be admitted right here that Great Britain has looked the problem straight in the face and has tackled it in an energetic manner that deserves the highest commendation. For after all, one of the first steps in any reconstruction problem is to house the suffering people of the country.

In previous issues of this journal we have illustrated and described the wooden houses of standardized design which the British have been erecting in large numbers to take care of the excess population in London. In the accompanying views we illustrate how the British have turned to concrete for erecting houses in the shortest possible time and with a minimum of expense and labor. These views show the erection of houses with concrete blocks, and it is reported that this form of construction is being widely employed at present. Despite the usual monotony of concrete block construction, the British, so it seems from the view of the completed house, have succeeded in obtaining pleasing architecture with the use of this building method.

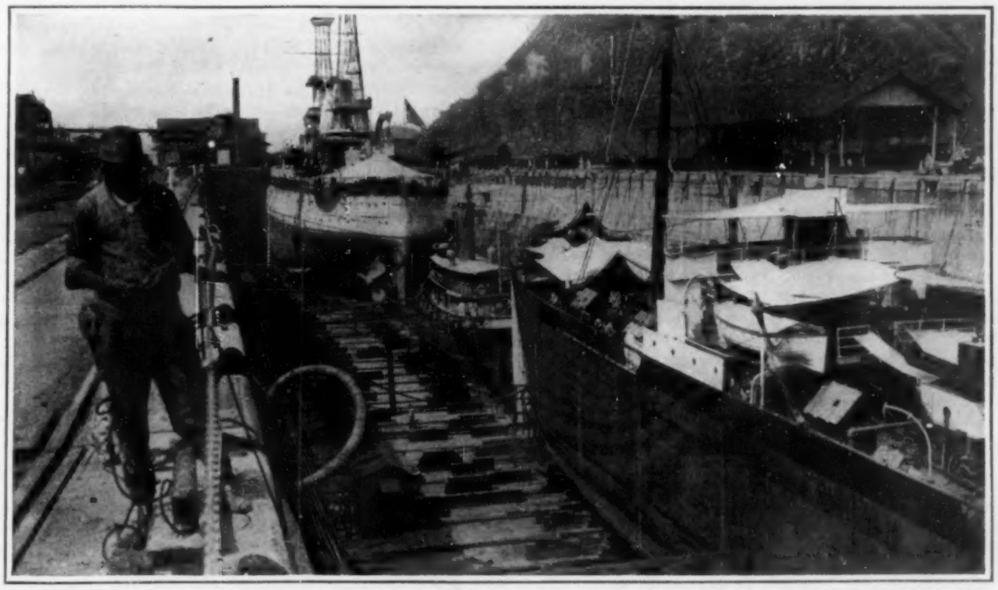
Nobel Prize-Winners

PRESS dispatches from Stockholm announce that the Nobel prize for physics for 1918 has been awarded to Prof. Max Planck, of Berlin University; the physics prize for 1919 to Prof. Stark, of Greifswald University (Germany); and the chemistry prize for 1918 to Prof. Fritz Habner, of Berlin University. The chemistry prize for 1919 will be held over until next year.

The Balboa Dry Dock

WE are all of us fairly well familiar with the physical characteristics of the Panama Canal, its great size, the difficulties and cost of its erection, and its large capacity. Not many people know that at the terminals of the canal some very large piers and warehouses and other structures have been built. This is true of both the Pacific and the Atlantic terminal, in each of which important harbors the Government has built some very fine piers of thoroughly up-to-date construction. Much of the work, including the great coal basins, has been designed on novel lines and especially to meet the conditions at the canal.

At Balboa, at the Pacific end, is a great dry dock capable of accommodating, with plenty of room to spare, vessels of a thousand feet in length, or over. This means that the "Leviathan," 950 feet in length, could be comfortably berthed. The location of the dock is not far from the great quarry from which so much of the rock for construction work on the canal was quarried. Some idea of its size may be gathered from the accompanying picture, where three vessels are represented as using the dock at the same time, namely, the battleship, "Rhode Island," an excursion steamer, and a deep-sea freighter.



Balboa dry dock, Panama Canal, finds accommodation at the same time for the battleship "Rhode Island," a small passenger steamer and a seagoing freighter

Research and Cotton

What Investigation Has Done in the Past for This Branch of the Textile Industries

By H. E. Howe of the National Research Council

EARLY in an industry, just as in the life history of the race, many things are discovered purely by accident, but as development leads to complexity real progress can come only from systematic study and research. We continue to speak of important inventions springing from accidental discoveries, as when Goodyear dropped a piece of gum in which he had incorporated sulphur upon a kitchen stove, thereby pointing the way to vulcanization; but such discoveries are not mere chance. The investigator in each instance has been a trained man on the keen lookout for the smallest piece of information that may be interpreted in terms of the solution for his problem. Indeed we will find that most of the great discoveries are the result of systematic work carried on co-operatively by numbers of patient, trained investigators taking every advantage of all the knowledge that has been gathered by others.

Research is used with a variety of meanings, so that it will be well to define to what we refer here when we employ the term. Research is not merely the collection of all the data which has appeared regarding a particular subject. Pure research is the creation of new knowledge and is usually undertaken for that purpose alone and without any consideration for its immediate practical application in the field of commerce. Industrial research, which is just as difficult, concerns the application of knowledge to specific production problems. Industrial research applies knowledge gained in any field of pure research and must write the dollar sign into its equation. Organized industrial research endeavors to put to work the many forms of power afforded by knowledge with the purpose of producing better things or of producing things more economically, or with special reference to some new requirement.

Great thinkers have repeatedly emphasized the dependence of progress upon science. Thus Lord Moulton has said: "Without the teaching of science man blunders through life much as a card player would blunder through a game of cards if he did not take the trouble to look at the cards in his hand and learn their value." There is a time in nearly every industry when production counts for most, but by and by wage scales change, increased transportation facilities create different conditions of competition, and other factors make it necessary to apply scientific principles rather than to rely purely on increase of capital, increased production, manual skill, and the like; and indeed the time comes when the industry must take steps not only to apply science to its operations, but to take an active part in training members of its staff to become proficient in the utilization of science and the application of the laws which it discovers.

A long while ago those interested in the success of the cotton industry recognized the importance of an alliance between that industry and science. The industry has of course used the results of scientific research but it has not contributed systematically to increasing that store of scientific knowledge with respect to the industry, without which progress cannot continue indefinitely. Many examples can be drawn from the cotton industry itself to prove conclusively the potency of science, and if anyone doubts the advisability of engaging systematically in scientific research on a large scale at the present time he need but consider in what state the cotton industry would now be if science had never been called upon to serve it.

In few industries have improvements along mechanical lines been so wonderful as in the cotton trade, due largely to the work of certain Englishmen. We have seen machinery produced such that one by one the operations which called for tedious labor have been performed by mechanical devices which operate almost as if they thought. This applies from the raw material up to the last steps in the process for finishing the goods, and the discoveries of the mechanical principles involved have by no means been accidental. They have called for painstaking research. Research has also given the cotton industry the process of mercerization, which not only increases the strength but adds luster to the fabric, thus creating a wider market for cotton textiles. Research has also contributed modern methods of bleaching, thereby removing many uncertainties and saving time and labor. In one instance a scientific investigation proved that one reaction which was thought to take thirty hours could be carried out under controlled conditions in forty-five seconds, with the result that but one-fifteenth of the capital invested in equipment was thereafter required.

One of the most valuable services rendered by scientific and industrial research to the cotton industry has undoubtedly been in connection with dyeing, for it has been the development of indanthrene and similar dyes fast to washing, light and bleaching, that has elevated cotton textiles to the class of high-grade materials, and permitted the production of qualities which appeal to the most discriminating. Not only are these dyes unusually fast in color, but they afford an array of brilliant shades which have done much to increase the popularity of many cotton textiles. Even the fragmentary knowledge which we have at present concerning starches, gums and other materials entering into the sizing and finishing operations has been of inestimable value, but fundamental knowledge of these complex organic bodies is very much to be desired. Whatever we may know at present concerning their chemistry and their reactions is due to research.

Research in the field of biology and botany has placed the grower somewhat in advance of the cotton manufacturer, due, in considerable measure, to the limitations imposed by marketing, banking and trading customs. The bionomist has achieved notable success in cotton as in work with other plants.

We find one group breeding varieties of corn for starch; another, successful in hybridizing tobacco so that twice the usual number of leaves suitable for wrappers are produced under the same general conditions of cultivation; still another, producing potatoes with nearly twice the customary starch content so that they will be more suitable as raw material for alcohol production or for starch; and again, walnut trees that grow with the rapidity of poplars and therefore bear their crop earlier than they otherwise would. So in cotton the grower and the manufacturer have been afforded improved varieties and have had methods devised that make it possible to grow good crops of cotton notwithstanding the serious weevil conditions. Through coöperation the production of Egyptian cotton has been established in certain valleys, and it was determined that this cotton was suitable for airplane wing fabric in the place of linen. However, it required an emergency such as the war to bring out this feature, and having learned a few lessons from the emergency it is our effort to have the momentum gained in these directions increased rather than diminished with the coming of peace.

WHEN we speak of research, we must remember that there are two kinds of activity included under this term. Pure research involves the creation of new knowledge; industrial research on the other hand aims at the more thorough application of existing knowledge to specific problems of production. Research of either type may of course lead to the other and frequently does so; the man who seeks new applications is apt to stumble on new facts, and the man who seeks new facts must often have his attention drawn to the applications of these facts. An excellent demonstration of how old and new facts may be turned to practical account is found in the past history of the cotton industry; and it is this story, with its lessons for the future, that Mr. Howe tells us here.—THE EDITOR.

Research has also found uses for cotton which benefit the grower and the textile manufacturer. The importance of the cotton fiber as raw material in explosives manufacture is an old story, but lacquers from cotton, artificial leather composed almost entirely of cotton and cotton products, and artificial silk are somewhat more recent. While much artificial silk is produced from other forms of cellulose, the type having the finest luster, the greatest strength when wet, and the least degree of inflammability, is made only from cotton.

Research has also added enormously to the value of the cotton crop because it has found so many ways of using its by-products. The seed which at one time was dumped into the streams of the South until it became a nuisance requiring legislation is now the raw material for industries whose products, on the basis of 1918 prices, added $35 to the value of every bale of cotton. This work on cotton seed has been of great economic importance, in increasing the food supply and, through hydrogenation, affording types of hard fat to re-enforce our supplies of animal fats.

It is probably fair to say therefore that the cotton industry is still living on investments made years ago in mechanical, physical, botanical, chemical and engineering research. Notwithstanding the work done by individual concerns, agricultural experiment stations, U. S. Department of Agriculture and other agencies, the industry as a whole has unquestionably drawn far more from the storehouse of scientific knowledge than it has ever put in, and the far-sighted ones now realize that if the cotton industry is to go forward as it should more research must be done by the industry itself. In Great Britain steps to form the British Cotton Research Association have been taken with the object of establishing in coöperation with the Government Department of Scientific and Industrial Research a scheme for the scientific investigation of problems arising in the cotton industry and to encourage and improve the education of persons who are or may be engaged in the industry. Included within the scope of its work is every stage of the cotton industry, such as the growing of the cotton, spinning, doubling, manufacturing, knitting, lace-making, dyeing, bleaching, printing and finishing, and the use of cotton cellulose for any purpose.

In America we have just begun to think about some of these things. The manufacturers and growers of cotton have identical interests and it ought not to be difficult for them to co-operate in the establishment of a research organization that could work wonders without making the expense for this insurance against ignorance more than a small part of the insurance premium against less dangerous losses.

Laboratory Tests in Built-Up Wood

FURNITURE manufacture, the making of gun stocks, wagon parts, sporting goods, panels, spokes of all kinds, and built-up wood of all sorts will be benefited by the experiments for aircraft construction being continued at the Forest Products Laboratory. These experiments were inaugurated by the War Department in the making of army airplanes and have shown the valuable uses to which built-up wood can be put and the high grade product which may result from building up from low grade raw material.

The proper drying and seasoning methods are studied and protective finishes are tested in various rooms of different humidities, the purpose being to subject the wood to the extreme atmospheric conditions that might affect it in the finished product. In one room is the salt moist air as of the sea, such as it would be in the hold of a ship, in another hot and dry desert conditions are duplicated, in another it is warm and moist as in a tropical region. In each, there are a number of struts and beams and propellers carefully balanced so that the atmospheric effects may be measured in the warping or overbalancing of the wood.

The experiments with plywood or wood made up of thin layers laid crosswise to one another and glued with water-resistant glues, are significant not only in airplane construction but in other wood manufacture where strength and uniformity are the important factors.

An effort has even been made to develop a substitute for linen from plywood for the wing covering in airplanes. Woven plywood may be available, the faces of the plywood being basket-woven from splints of spruce veneer 1 7/32 inches wide and .017 of an inch thick, and the core being of spruce 1⅞ inches wide and .018 of an inch thick. The total thickness is almost one-fifth of an inch. The waterproof quality of the glue to be used in built-up wood is very important and is tested either by boiling in water for a period of eight hours or by soaking in water at room temperature for ten days. The plies must not separate after drying.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

What the Mail Man Brings Us

To the Editor of the SCIENTIFIC AMERICAN:

I have been reading the SCIENTIFICAN AMERICAN for twenty-five years. I appreciate your efforts in the last few issues. W. P. FORBES.

Hackett, Ark.

To the Editor of the SCIENTIFIC AMERICAN:

Your issue of October 25th is before me. I am pleased to know that you have sand enough to take a stand against the labor trust. J. F. CAMPBELL.

Kingman, Me.

To the Editor of the SCIENTIFIC AMERICAN:

Just a word to let you know that as a subscriber we are back of you in this fight and while you are at it do a good job—clean them up!

If you ask *us* what we do with the paper after we get it, your ideas on that "souvenir" business might change. What do you do with this letter? Certainly we no longer keep them with the family Bible (if we have one); nor do we have them bound. We give them the once over and pass them along.

Here's to success, knowing you will win.

EDGAR H. HOWES.

Los Angeles, Cal.

To the Editor of the SCIENTIFIC AMERICAN:

As one of your subscribers, I want to congratulate you on your success in producing a magazine under serious difficulties. I look forward to a story telling us how it is done—how an editor can get out a paper every week by aid of his trusty typewriter and without the aid of compositors. Tens of thousands of American editors who are not yet up against it, but may be some day, will be immensely interested in the technical details. How do you make corrections without retyping the whole page? I notice that in some cases you doctor up a wrong letter, but the —— evidently rewrites the correction before making up the page, or at least before engraving. How do you justify? How do you insert cuts?

I note under the microscope that the —— shows type badly broken, with many of the fine lines rather dim. On the other hand, the SCIENTIFIC AMERICAN type reproduces very black and is easily read. My guess is that the—— engraves from the photographically poor black of the typewriter ribbon, while you touch up the type or employ a ribbon that gives a better photographic effect. We editors would be glad to know about that, too. S. T. HUGHES.

Cleveland, Ohio.

[*We shall be pleased to tell any of our colleagues anything which they want to know about our recent experiences, and which may not be entirely clear to them from the article of last week.*—THE EDITOR.]

To the Editor of the SCIENTIFIC AMERICAN:

Permit me, as the librarian of the Athenaeum of Philadelphia, to compliment and congratulate you on the proper spirit you have shown in meeting and overcoming your strike problem in the typewritten issues of the SCIENTIFIC AMERICAN. LOUIS K. LEWIS.

Philadelphia, Pa.

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN is always more than welcome, but the recent issues seemed better than any of the others, not for the superior contents, but for the ingenuity of the printing, the spirit of the paper, the grit and determination of the publishers to stand out aganst the unreasonable demands of a single class of workers. Public sentiment is with you; stand pat.

I am enclosing check for another year's subscription; print it in any way you can. CLEON M. MASON.

New Boston, Ill.

To the Editor of the SCIENTIFIC AMERICAN:

I am just back from France, where I went to fight for right—but whence I returned to find that we have fought, and my comrades have died, to make this country safe for Bolsheviki, Labor Unions, and the I. W. W.

I thought it had all been useless until I picked up a copy of the SCIENTIFIC AMERICAN for November 15th. Your courage and independence give me new hope.

LIEUT. THREE STRIPES.

Camp Dix, N. J.

Science Serves Humanity

To the Editor of the SCIENTIFIC AMERICAN:

I wish to commend most heartily your article in the issue of November 8th, entitled "Am I My Brother's Keeper?" Such an article seldom appears in a scientific journal, which is supposed to concern itself entirely with material progress. It is distinctly refreshing to see an article of this nature published in the columns of a scientific paper of such high standing as the SCIENTIFIC AMERICAN.

Unless science becomes subservient to the best interests of humanity, it may prove a curse instead of a blessing. The railroad and steamboat are of tremendous benefit when they haul food, clothing and other necessities to the needy of the world, and thus produce comfort and often gratitude in the recipients, but when they carry the munitions of death and destruction, they not only destroy human happiness, but often destroy the very means of a livelihood and frequently cause innocent people to undergo indescribable suffering and injustice.

It is to be earnestly hoped that the spirit in which the Americans entered the late war will not be obliterated for the sake of self-interest and sordid gain, but that every true American will realize that in order to keep step with the world's progress, we must be fully alive to its best interests as well as to our own.

ELWOOD HAYNES.

Kokomo, Ind.

Fundamentals in Flying

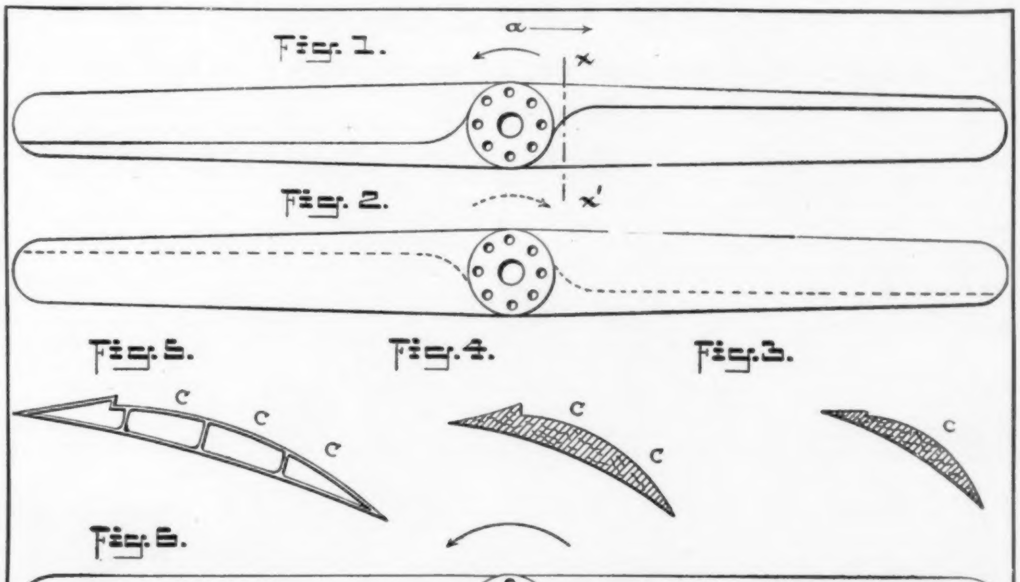
To the Editor of the SCIENTIFIC AMERICAN:

In this epoch of venturesome and sensational voyages holding us spellbound because they mean so much for commerce and the intercourse of nations, there has been much said about mooted problems of fixed landmarks, marine and fog signals, weather, wireless, etc., but how about fundamental principles which play the important rôle in all things constructive, and, which, in the evolvement of the sciences, arts, crafts and even ethics has ever tended to render prior conceptions obsolete? We will not think long to realize how many times this has been demonstrated in the history of human achievement. If then, perchance, in this formative stage of air navigation the art is susceptible of organic improvement it should be known, and the courtesy of your columns is asked to illustrate a neglected phenomenon and its possibilities.

We all know, Mr. Editor, that materials like arguments have more than one side and we wish to show that this applies potentially to air propellers and wings—screws and planes. Back in the nineties the writer in lectures before societies and colleges contended that the size of air tractors which is thought the most effective is in fact the least effective, and the first thing that was to have been demonstrated at Columbia University was to what extent aviation benefited the air propeller problem. (As to airplanes their possibilities had not yet been demonstrated by the Wright brothers.) The reasons for the changed construction of aircraft propellers shown in our sketch will be understood by reference to the definition of cavitation in the New Standard Dictionary, to wit:

"The causing of a vacuum to form about a revolving propeller or fan, thereby reducing efficiency. Specifically, in marine engineering, a condition in water in which the space immediately in rear of the propeller-blade of a ship is rendered more or less empty on account of the rapid cleavage of the water by the propeller-blade and the relatively slow action of the water in closing in behind the moving blade."

A truism of geometry says that things equal to the same thing are equal to each other, hence if cavitation on one side of a tractor of any kind subtracts from its efficiency, I submit it is axiomatic that cavitation on the opposite side adds to its efficiency. A simple theoretic analogy is an air piston in an air-tight cylinder. We force the piston to one of its ends and what do we have but compressed and rarefied air?—two stored powers which can be used jointly or separately, and when used jointly we approximate double the potential energy of either. Therefore utilize both thrust and suction by intensifying cavitation *in front* of screws, and *on top* of planes. That is to say use both sides of screw or plane with result of greatly increased buoyancy, or load-carrying capacity per unit of power for planes and, owing to their greater relative velocity in the air, still higher increased traction of screws for greater speed of translation per unit of power. In other words would it not mean increased efficiency for all aircraft; and as a corollary to this, large size and great capacity, or smaller machines of less head resistance and skin friction for 200 miles and over per hour?



Types of propeller blades designed with reference to the favorable cavitation which they will set up in the air through which they rotate

Again, and importantly, to double the traction of the air propeller would obviously double the life of the engine running it; and those who ought to know full well say it would not only double but quadruple the life of any and all aerial motors. Economists are dumbfounded when confronted with a prime mover costing from five to seven thousand dollars, the average life of which, when driven to the peak of endurance, is about one hundred hours.

How the cavitation effect may be accentuated in the functioning of any plane or propeller is shown in the drawing where Fig. 1 is a "toothpick" type of screw seen from front of airplane, and Fig. 2 is the same viewed from the fuselage of the machine. Fig. 3 is a cross-section of Fig. 1 on line *xx* looking in the direction of arrow *a*. Fig. 4 is a modified section. Fig. 5 is a section of metalized plane or screw formed as a parallel-member truss. Fig. 6 is a screw type much used by the French and called by them the "normale" on which, as in other figures, is located a cavitation rib. Letters C. C', etc., indicate location of intensified cavitation because of the rib, and obviously the higher the speed of revolution the greater the partial vacuum effect due to the rib. Instances have occurred with

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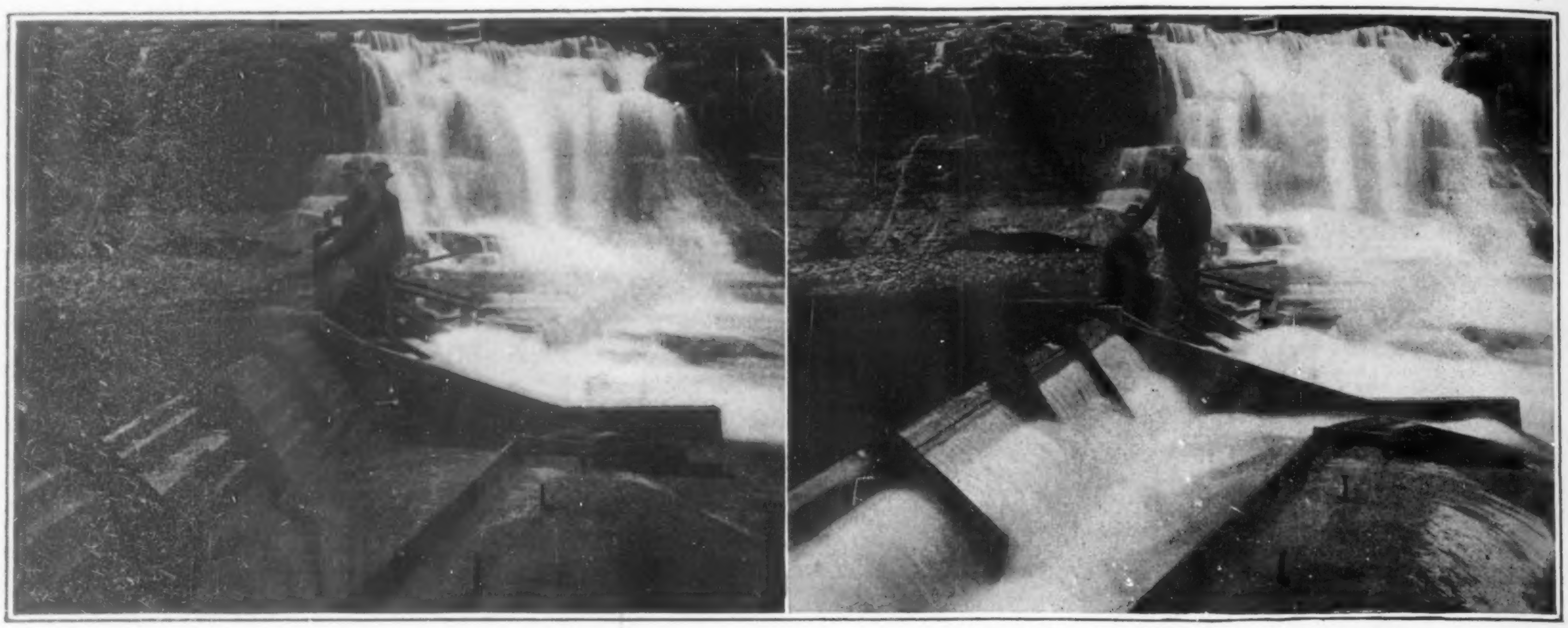


Showing the step construction and the spillway channel — This view shows the behavior of water in spillway channel

Model dam with spillway channel along its front

The Gilboa Dam

Another Proof of New York City's Long Look Ahead for Its Water

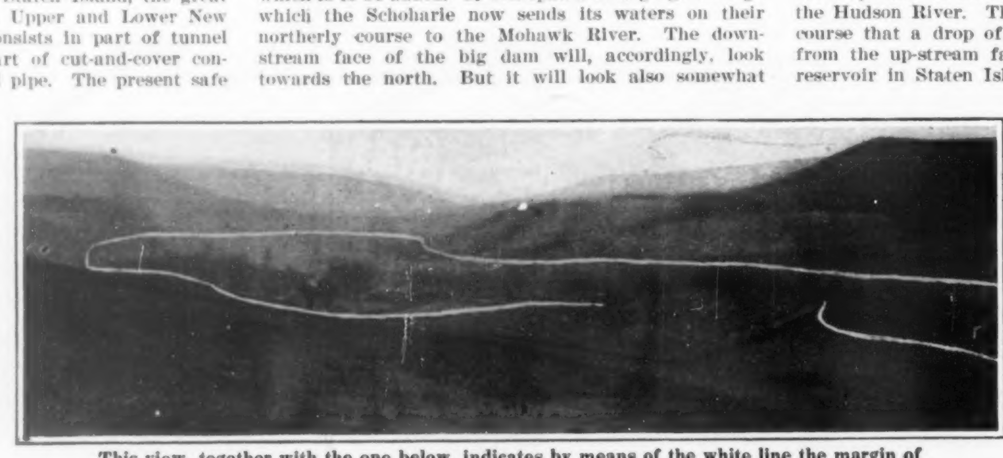
By J. F. Springer

THERE is probably no other great city in the world which possesses a water supply comparable with that of New York. With the exception of a few districts, the entire metropolitan area with its 6,500,000 population, is supplied from distant and sparsely settled watersheds. The more notable of these is the Esopus watershed in the heart of the Catskill Mountains. This source of supply is connected with the great city by an enormous aqueduct stretching from Ashokan Dam, far to the north and on the west side of the Hudson River, to Staten Island, the great island borough lying between Upper and Lower New York Bays. The aqueduct consists in part of tunnel through the solid rock, in part of cut-and-cover construction, and in part of steel pipe. The present safe capacity is 250,000,000 gallons per day. All this water comes from the one watershed. But, north of this valley is another, the watershed of Schoharie Creek. It is capable of supplying the city with another 250,000,000 gallons per day. But its water must be gathered and transmitted under control to the present Catskill Aqueduct, and certain unfinished sections of this conduit enlarged to full capacity. This work of including the Schoharie Valley among the contributors to New York's water supply was part of the original general plan.

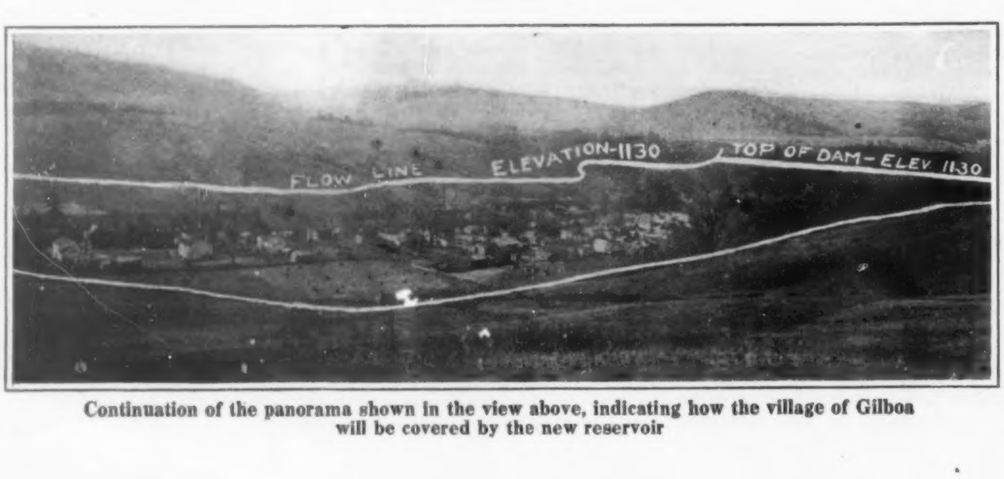
Construction upon this complementary feature has already begun, but the work is of such size that it will probably not be completed for four or five years. It includes the preparation of the region whose present artificial and natural features will be wiped out by the impounding of the water of the valley. It also includes the construction of the great Gilboa Dam whose function it will be to effect storage and control of the Schoharie waters. Then there is, in addition, the notable feature to be known as the Shandaken Tunnel, whose duty it will be to pass the gathered waters through eighteen miles of the rocky ridge which separates the watersheds of Schoharie and Esopus Creeks. In order to complete the new work and render these waters available, it will be necessary to do a considerable amount of miscellaneous construction and especially to add second and third steel siphons at numerous small valleys crossed by the mighty aqueduct on its way to New York City.

Gilboa Dam is perhaps the most notable single feature which is to be added. It will span a rock gorge through which the Schoharie now sends its waters on their northerly course to the Mohawk River. The downstream face of the big dam will, accordingly, look towards the north. But it will look also somewhat to the west. Schoharie Reservoir, the lake created by the dam, will stretch to the southeast. On the present eastern shore of the stream is strung the larger proportion of the buildings of the town of Gilboa. The dam divides the cluster of houses, where the population is mostly centered, into two parts, the greater part lying to the south and being included in the area which will be flooded by the reservoir. In fact, the center line of the dam almost passes through a church spire. The site of the dam is just about 120 miles north of the City Hall in New York and some 35 miles west of the Hudson River. These are air-line distances. The course that a drop of water will pursue in traveling from the up-stream face of the dam to the terminal reservoir in Staten Island will be more or less tortuous for the reason that straight-line construction of the great system was out of the question. Many valleys had to be crossed—one of them being that of the Hudson River itself—and the natural topography followed to some extent. All in all, the drop of water will travel some 156 miles. At the start it is, say, 1,130 feet above the sea level. When well on its way, it passes through the great Hudson River Siphon and reaches a level of some 1,100 feet below the surface of the river. Before it gets to the farthest possible point south, it will have flowed downhill and uphill on the sides of numerous small valleys on the west side of the Hudson, will have passed through the great city in a deep tunnel, will have crossed beneath the East River to Brooklyn Borough, and finally flowed beneath the celebrated Narrows, and into Staten Island.

Schoharie Reservoir will impound water coming from a watershed of 314 square miles. With the drainage area of 257 square miles immediately back of Ashokan Dam and the 22 square miles of emergency water-



This view, together with the one below, indicates by means of the white line the margin of Schoharie reservoir



Continuation of the panorama shown in the view above, indicating how the village of Gilboa will be covered by the new reservoir

shed in the vicinity of the great Kensico Dam and Reservoir not far to the north of the city, the total area ultimately tributary to the aqueduct will amount to 593 square miles. The capacity of the lake created back of Gilboa Dam will be 20,000,000,000 gallons—enough to supply its quota for 80 days. The fact that the general elevation of the southerly part of Schoharie Creek is greater than the altitude of the upper reaches of Esopus Creek makes it possible to pass the water from the new reservoir through the Shandaken Tunnel already mentioned. The water emerges from the tunnel after its passage beneath the main ridge of the Shandaken Mountains and empties into the natural bed of Esopus Creek at the village of Allaben in Ulster County. The elevation here is about 969 feet.

Schoharie Reservoir is regarded as having a small capacity relatively to the tributary watershed. But the storage of Schoharie Valley water is provided for in part by the enormous Ashokan Reservoir, whose capacity is some 128,000,000,000 gallons. Schoharie Reservoir is, in fact, a diverting reservoir and is to be operated as such. The total possible storage for the whole Catskill Aqueduct system is impressive, amounting to 177,000,000,000 gallons.

The contract for the construction of Gilboa Dam was let in June, 1919. The amount to be paid for the construction of this work and its appurtenances is, if one bases the estimate upon contract quantities and unit prices, $6,819,910. It is thus reckoned to have a value in excess of 30 per cent of the total estimated cost of the entire Schoharie development, that estimated cost being $22,175,400. It may surprise some that this work should be undertaken now when the cost of everything is so high. But, what seems to have weighed decisively, is that unless the work is begun now, the city will be later on again involved in pumping enormous quantities of water at a frightful expense. It is claimed that, just as the city was relieved in 1917 of an annual expense for pumping of $1,300,000 by the inauguration of the delivery of water from the drainage area of Esopus Creek, so will it again be spared, and spared to the same extent or more, by the addition of the Schoharie supply towards the close of 1924.

The masonry section of the dam is to have a length of 1,320 feet, all of the spillway type. The height of this portion, which will occupy the eastern part of the gorge, will be 160 feet. On the west side of the gorge, there will be an earthen embankment some 1,000 feet in length. Altogether, then, the dam will have a total length of some 2,300 feet—something in excess of two-fifths of a mile. Naturally, the masonry section will be much thinner from face to face than the earthen portion. At the junction of the two, the

(Continued on page 623)

Two views of the board mattress used for carpeting a river bed

Keeping a River in Place With a Board Mattress

WHEN the engineers of the Little River Drainage District, in Missouri, saw the damage that was being done to the river bed in a contracted section of one of their drainage channels, they decided that it would be necessary to sink a strong board mattress to prevent this repeated destruction. Accordingly they laid their plans for building such a mattress in a unit, making it 300 feet long and 40 feet wide. To launch this successfully was considerable of a problem, but the general plan was to build it in the air above the channel, suspending it on stout wires stretched from deadmen at the top of the bank. Then boards varying in length from 12 to 16 feet were spliced and lapped to form lengths about 50 feet long running with the current. When half a dozen boards were nailed together in these lengths, the workmen would push them off the bank on to the tightly strung wires, then climb out on them to proceed with the work of building the mattress. After they had securely laced and wired the boards into a mat they fastened a ⅞-inch cable to the upstream end and to a deadman on top of each bank, to hold the mat steady when it was launched. Cross-poles were used to hold the riprap in place after the mat was sunk, and at each side a line of poles was placed running lengthwise to control the side slope riprap.

When the mat was finished, heavy rocks were piled on the upstream end to weight it down into the water; it took but a little while for the swift current to submerge the entire structure, this work being speeded up by tapping on the wires with a hammer and thus breaking them. Then the riprap was dumped on from a suspension bridge across the channel.—*George F. Paul.*

The St. Louis Municipal Docks

THE city of St. Louis took up the construction of docks and river terminals with the idea of opening up the river and making St. Louis an inland port, connecting with Cairo, New Orleans, and all the great seaports of the world, so that raw material and manufactured goods from the interior of the United States could the more easily reach the outside world.

Of the six sites suggested, the section opposite North Market Street was chosen, as it is very close to the business district, and is surrounded by many manufacturing and shipping concerns and by railroad yards which radiate into South and North St. Louis, the Mill Creek Valley, the Northwest Belt Line, and across the river into Illinois. The harbor lines at this location were far enough out from the wharf line to give ample facilities for the construction of warehouses, storehouses, and railroad terminals behind the docks, and for the future extension of the dock north or south to North Market Street. The depth of the river bed between the inner and outer harbor lines was sufficient to meet the Government requirements, and permission was obtained from the Government to locate the face of the dock half-way between the harbor lines, on condition that the city keep the river bed between the dock face and the outer harbor line clear from obstructions and sediment to a depth of 10 feet below zero on the gage, so as to enable loaded barges and boats to reach the dock at the lowest stages of the river. This position of the dock brought the dock wall about 250 feet in front of the river bank, necessitating the placing of about 500,000 yards of fill, upon which warehouses and railroad tracks could be built.

So as to hasten this fill, the dumping of city dirt and refuse was encouraged, and two wooden-pile dikes were immediately constructed, about 150 feet and 900 feet,

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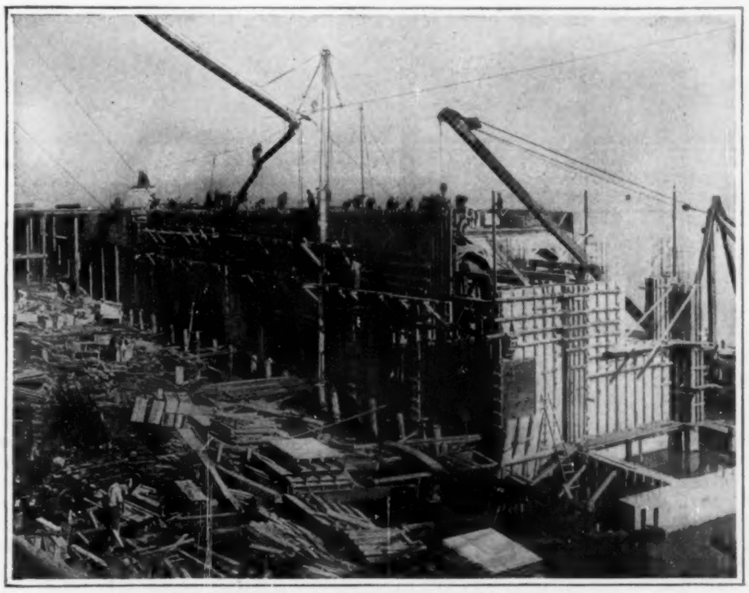
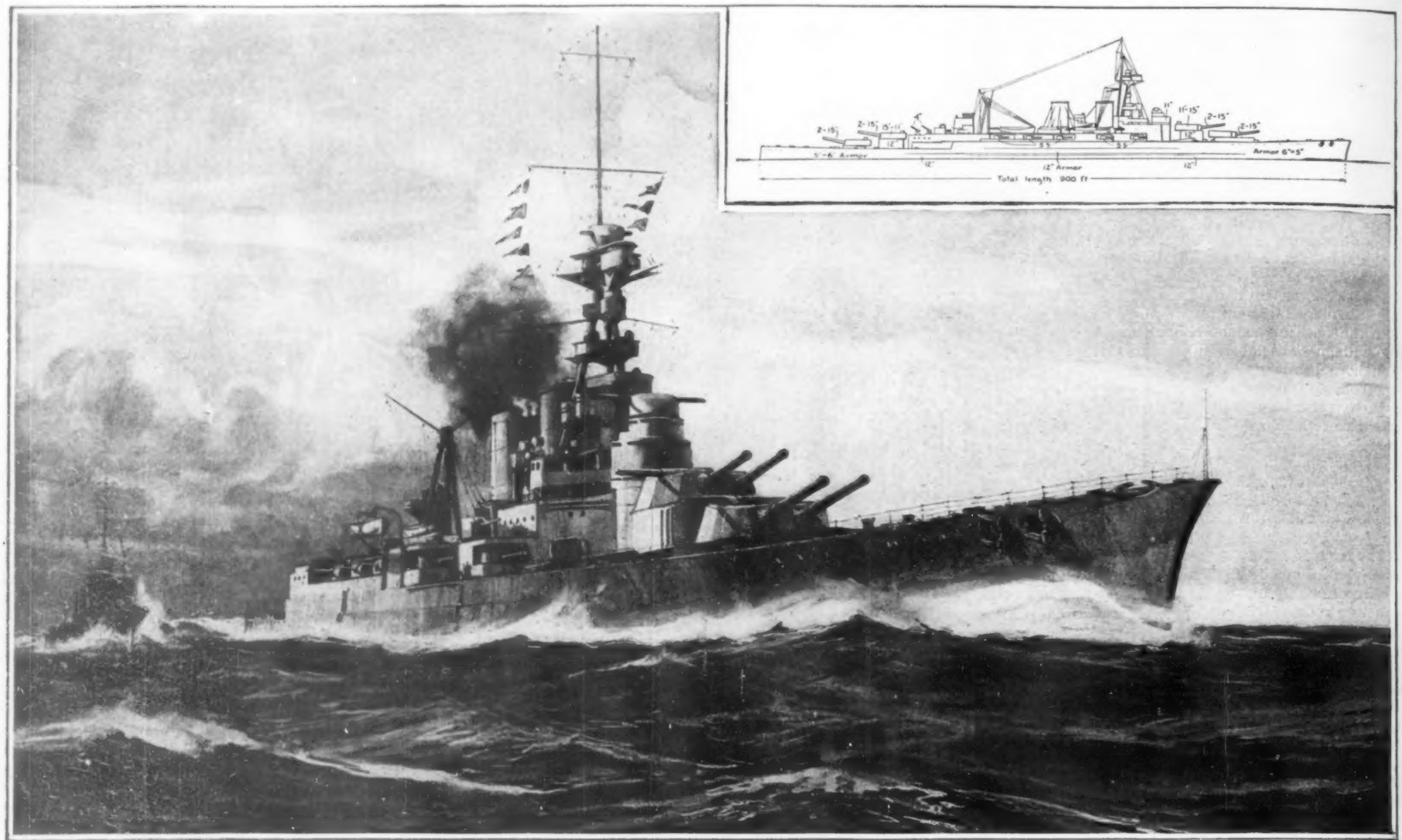


The second unit of the St. Louis docks under construction

Left: **The north end of the project, showing the timber dike that has reclaimed 25 acres of land.** ***Right:*** **View from the river showing two units completed and the third under way**



Courtesy of *The Graphic* (London)

Length: 900 feet. *Beam*: 104 feet. *Horsepower*: 144,000. *Contract Speed*: 31 knots. *Armament*: Eight 15-inch, twelve 5.5 inch. *Armor*: Belt 12 inches; turrets, 15 inches. *Displacement*: 42,000 tons. *Designed in 1916*, after the Battle of Jutland.

The 31-Knot British Battleship "Hood"—A New Type

The Thirty-One Knot British Battleship "Hood"

A Ship with the Guns and Armor of a Battleship and the Speed of a Cruiser

PURSUING their policy of making known to the public the main details of the design of the fighting ships they laid down during the war, the British Admiralty have given to the technical press illustrations and very complete descriptive matter of their latest capital ship, the much discussed battleship "Hood." Four of these ships were projected and laid down and were named after four famous British admirals, Hood, Anson, Rodney and Howe. They were designed to meet the three German battle-cruisers of the *Graf von Spee* class, which it was learned that Germany had laid down, and which were to be armed with the 15-inch Krupp gun. Inasmuch as their designs were drawn in 1916, and subsequently to the battle of Jutland, it is reasonable to assume that they embody the lessons taught by the greatest sea fight in all history.

There was some discussion as to the advisability of mounting six 18-inch guns in preference to eight 15-inch guns; but since the 18-inch gun weighs 165 tons as against 98 tons, and the 15-inch gun had proved, in test, to be remarkably accurate up to 30,000 yards and was capable of penetrating most armor at that range, it was felt that the advantage gained by the greater penetrating power and more powerful bursting charge of the 18-inch shell would be more than offset by the more voluminous and more rapid fire of the 15-inch shell, although the 18-inch shell weighs 3,200 pounds and the 15-inch shell only 1,925 pounds. So the 15-inch gun was adopted as the central controlling element, around which the new ship should be built.

The armor plan, as will be seen from the accompanying table, which is reproduced by the courtesy of *Engineering*, is, to our thinking, an improvement over that of the battleship "Queen Elizabeth," which has given great satisfaction and is generally approved on the other side of the water. The defense of the barbettes and turrets, or "gun houses," as the British call them, is to be respectively 12-inch, 15-inch and 11-inch, as against 10-inch, 11-inch and 11-inch in the "Queen Elizabeth." The deck protection is similar except that the main deck is increased to 1½ and 2 inches as against 1¼ inches. In view of the fact that at Jutland battle, the "Warspite," sister to the "Queen Elizabeth," due to injury to her steering gear, circled in to close range of the German battleship line, and was exposed for a considerable period to the concentrated heavy-gun fire of several battleships, receiving between thirty and forty big-gun hits, and came through without vital injury, this armor plan must be considered to be highly efficient. The torpedo defense battery has only 5-inch shield protection; but if we remember that in some of our latest battleships, armor protection for these lighter guns has been abandoned, it must be considered that the "Hood" is fairly well placed in this regard, although it is true these guns would be in danger of being swept away by a hit from a big-gun salvo by the enemy.

It is when we come to the matter of speed that the battleship "Hood" stands in a class by itself, there being no other battleship built or building, or even projected, so far as we know, that compares with her. It is here that she leaves her progenitor, the "Queen Elizabeth," far behind. The "Queen Elizabeth" and her class have a speed of 25 knots and have made it consistently. But the "Hood" is designed to be six knots faster. That is to say, the contract calls for 31 knots; but, as is inevitably the case with turbine-driven ships, she will probably do better and make about 32 on her trials. This speed is to be secured by oil-fired boilers and Brown-Curtis turbines which are designed to deliver 144,000 shaft horse-power. The proper ratio of the speed between turbines and propellers is to be secured by mechanical reduction gear of the type which has proved so successful in the latest high-speed ships built for the British Navy. The

(*Continued on page 624*)

	Hood.	Renown.	Tiger.	Queen Elizabeth.	U.S.S. Constitution.
Year of launch	1918	1916	1913	1913	1920(?)
Length (p.p.), feet	860	750	660	600	825
Beam, feet	104	90	90½	90½	90
Draught, feet	28½	25¼	28½	28¾	31
Displacement, tons	42,000	26,500	28,500	27,500	34,800*
Shaft horse-power	144,000	112,000	108,000	75,000	180,000
Speed, knots	31	32	30	25	35
Fuel capacity, tons	4000 (oil)	4250 (oil)	3320† (coal)	3400 (oil)	5000 (oil)
Armament	8 15in.	6 15in.	8 13.5in.	8 15in.	10 14in. (or 8 16in.)
	12 5.5in. 4 4in. A.A.	17 4in. 2 3in. A.A.	12 6in. 2 3in. A.A.	12 6in. 2 3in. A.A.	18 5in. 4 3in.A.A.
Armor—					
Side, amidships	12in.	6in.	9in.	13in.	—
Side, forward, and aft	6—5in.	4—3in.	4in.	6—4in.	—
Barbettes	12in.	7in.	9in.	10in.	—
Gun-houses	15in., 11in.	11in.	9in.	11in.	—
Conning-tower	11in., 9in.	10in.	10in.	11in.	—
Upper deck	2in.	½in.	1½in.	2in.	—
Main deck	1½in., 2in.	3—1in.	1in.	1¼in.	—
Lower deck	1—3in.	2½in.	1—3in.	1—3in.	—

*This figure is purely nominal. Recent advices indicate that the Constitution will displace at least 39,000 tons when in sea-going trim.

†Tiger is also designed to store a large quantity of liquid fuel.

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Conducted by H. E. HOWE, Chemical Engineer

The Chemical Exposition

THE Fifth National Exposition of Chemical Industries, held this year the week of September 22nd in Chicago, again as in other years demonstrated the continued progress of chemical industry in America. The several hundred exhibitors displayed a wide variety of apparatus and chemical products encouraging to those interested in the permanence of the industry.

Many things missing last year were in place this time, and the gaps in many lines are rapidly being filled. The appearance of instruments for testing and control work was marked, for while we have always had excellent instruments of several types made in America, we have never had polariscopes, refractometers, spectrometers, and the like. All this is now changed. Likewise, heretofore the high grade filter paper, especially for quantitative analysis, has been imported, but at the exposition samples were distributed which left no doubt but that in this important item we are now to be quite independent.

This paper is now being made in a small American mill where the lots are of such size as to afford accurate control and novel precautions are taken to insure a constant supply of absolutely pure water. Such filter paper represents the purest type of commercial cellulose carefully bleached and acid washed to remove silica as well as other impurities. Such paper must retain very fine precipitates and filter rapidly. It must be uniform and have the smallest possible amount of ash. In tests this American paper has withstood acid and alkali as no other paper has.

There were many working exhibits, including two of molding plastics, a modern development in organic chemistry, which has given us resin-like bodies suitable for many purposes. Some remarkable dyes were also to be seen and attention was drawn to the many uses for industrial alcohol. American porcelain showed further refinement both in laboratory and factory ware. Here, too, for the first time a large number of chemically pure rare organic chemicals were on display. These compounds are essential in much research work, yet owing to small demand, very large variety and large expense of purification, their preparation is not commercially attractive. The company which took up the matter did so purely from patriotic motives and in the interest of research. A line of pure sugars for bacteriological investigations was also shown. The interest of other industries in chemistry was demonstrated by their increased representation at the exposition.

During the same week the American Steel Treaters Society held an exposition in connection with their annual meeting. It was a very encouraging beginning and embraced machinery and apparatus of interest to the steel treater. The week of September 29th saw a great convention of the American Foundrymen's Association in Philadelphia with an accompanying exhibit rivaling displays in such lines usually confined to world fairs.

The trades fully appreciate these opportunities to examine the latest improvements, to make comparisons and to meet those with whom they have so much in common. These special shows offer unusual opportunities for self-education and for students in the vicinity. Instructive programs accompany the displays, motion pictures contribute their share (especially since the perfection of moving line drawings), and there is usually ample opportunity afforded for discussion.

Chemistry and Our Food

WORK in progress at the Minnesota Agricultural Experiment Station tends to prove that the milk produced by cows on a diet of dry fodder and grains is not as nutritious as when the cows are pastured on green grass. Further, the more nutritious milk is found to be more potent in preventing the scurvy which often attacks babies. As a result of these experiments it may be found advisable to take another step in improving milk produced primarily for infants and invalids. We see to it that the fat content is not below a reasonable limit. Precautions are taken to eliminate preservatives; methods for keeping the bacteria count below a safe limit and insuring the absence of especially dangerous forms are perfected; animals and dairies are inspected; efforts are constantly being made to improve bottling and transportation. Now comes the possibility of maintaining maximum values in these special directions by the proper use of green food stuffs in which the silo plays an important part. Ere long we shall want to know what the cows producing our certified milk had for dinner!

Another important point is that rhubarb juice has been found practically as efficient as orange juice in preventing and curing scurvy in young children. Orange juice has usually been considered a desirable if not a necessary item of a child's diet and yet many could not afford to provide it in sufficient quantity. This new property should add to the appreciation for the common garden plant which on the basis of this investigation may be found almost as efficient in scurvy cases as raw lean beef, the power of which, in such cases, has been overestimated.

American Institute of Baking

FOR the last two years or more the most progressive members of the American Institute of the Baking Industries have been working toward the establishment of an American Institute of Baking. It has been planned to have the institute take the initiative in fundamental research on problems affecting baking, to assist in questions of immediate production, and to further the education of those engaged in or about to engage in the baking industry. Not only is such effort of concern to the public at large, but it has an immediate beneficial influence on the more than 28,000 baking establishments in this country. In every case where coöperative research has been undertaken by an industry, either through concerted action or on the initiative of individual establishments, the status of that industry has been improved to the advantage of all concerned.

Late in September at their Chicago meeting the bakers completed the initial steps in the organization, subscribed sufficient funds to begin work and announced arrangements with a well established educational institution to provide courses in those subjects germane to baking. The industry is to be congratulated on this definite step toward an organized program of research.

It is an example of what coöperation can do. Of the 28,000 bakeries, about 7,500 use more than 50 barrels of flour each month and only 2,500 require 200 or more barrels for their monthly needs. The results of science applied to their questions could have been made available in no other way to by far the greater number in the trade. The possibility of obtaining similar coöperation in other industries is being studied by the National Research Council of Washington, whose objects are the stimulation and promotion of scientific and industrial research.

An Import License System for Dyes

TO those who have carefully studied our history in the manufacture of dyes it seems strange that any opposition should have arisen to the system of licensing for imports proposed by the Chemical Foundation and somewhat similar to the plan adopted in England. We have a large sum invested in our dye industry but it is not established on a really permanent basis even yet, and it does not seem that it can be without the kind of protection which only a proper license system can give.

High tariff is not the panacea for all cases that its friends imagine. It has failed to give us a dye industry in the past and will no doubt fail to do so in future. It is not likely to discourage German manufacturers who are skilled in overcoming such handicaps. On the other hand, the license plan compels support of our new industry in which about four hundred millions are invested, without working any hardship. It provides for the importation of any dye which is needed and is not made here, cares for the matter of fair prices and at the same time prevents the sort of competition which would simply stifle the American dye industry.

Are the opponents of a licensing system pro-German or does their selfishness make them suddenly forget those whose enterprise proved the salvation of the dye users during the past four years in favor of a temporary desire or advantage? On any ground whatever it is difficult to conceive of any objection to the license plan that will stand the light of day.

Magnesite Flooring

WHEN the mineral magnesite is calcined at about 1,600° F. a caustic burned magnesite containing from 2-4 per cent carbon dioxide is produced. When this magnesium oxide is mixed with a solution of magnesium chloride of the proper density a peculiar phenomenon takes place, resulting in a hard compact mass called Sorel cement or Magnesium oxychloride. When suitable fillers are incorporated a tough mass of great utility for flooring is produced.

This flooring has strength sufficient for the purpose, can be formed as desired and unlike Portland cement it is possible to cut, saw, nail and force screws into it. It has ability to resist fire to a reasonably satisfactory degree and is also a heat insulator. Its cost permits its use in competition with other types of permanent flooring in all cases and it has been installed in railway cars, on ship decks, and in public buildings. The composition is also useful as pipe covering, in stucco and in slabs.

Although known for 20 years, magnesite flooring has only been considered commercial during the last 6 or 8 years. It now consumes about 10 per cent of our magnesite ore production and its manufacture employs more than 5,000 men by some 200 concerns. The characteristics of this flooring should commend it to builders and with a return to normal conditions the further development of the industry should be amply repaid.

Vanadium

AMERICAN interests will continue to control the largest known deposits of vanadium through the organization of a new company which will operate various vanadium properties. One of these in the Peruvian Andes is said to contain 95 per cent of all the known vanadium, the ore carrying an unusually high concentration of metal.

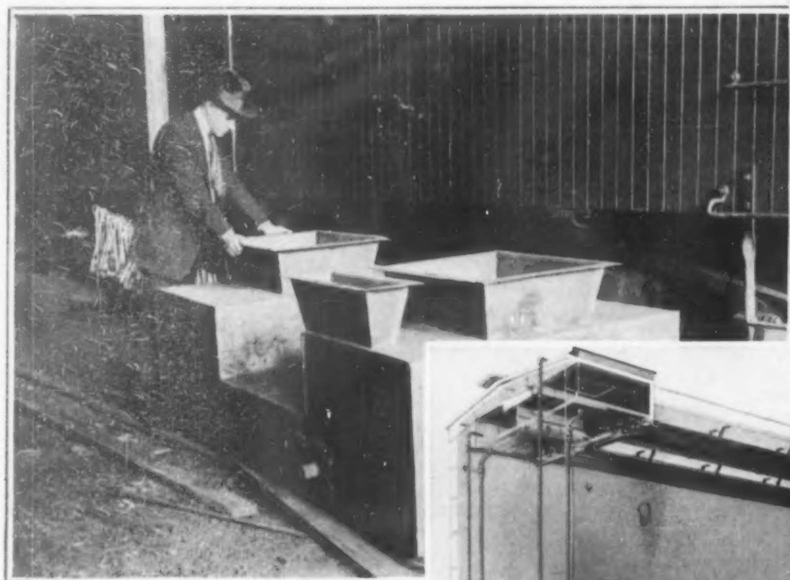
Vanadium has become one of the vital factors in the steel trade, entering into the manufacture of automobiles very extensively. Four pounds of vanadium added to a ton of steel results in an increase of 45 per cent in its strength and at the same time produces an alloy steel which has satisfactory machining qualities. The statement has been made that while the difference in raw material cost between vanadium steel and a carbon steel of approximately the same strength is too small to be of consequence, the difference in machinability makes a finished part of vanadium steel cost \$6.50 and of carbon steel \$13.00. It becomes evident that an alloy steel may frequently be employed for economic reasons alone, but that is a point much in favor of such alloys as vanadium steel which give us strength at low cost in construction. Some very important work remains to be done in the alloy field as we know all too little of the influence of many of the rarer metals on both ferrous and nonferrous alloys.

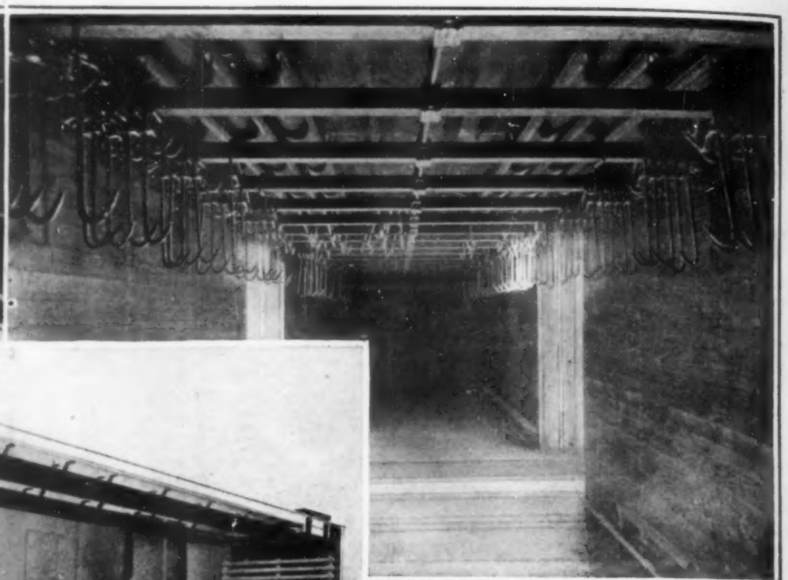
The Workman's Tools

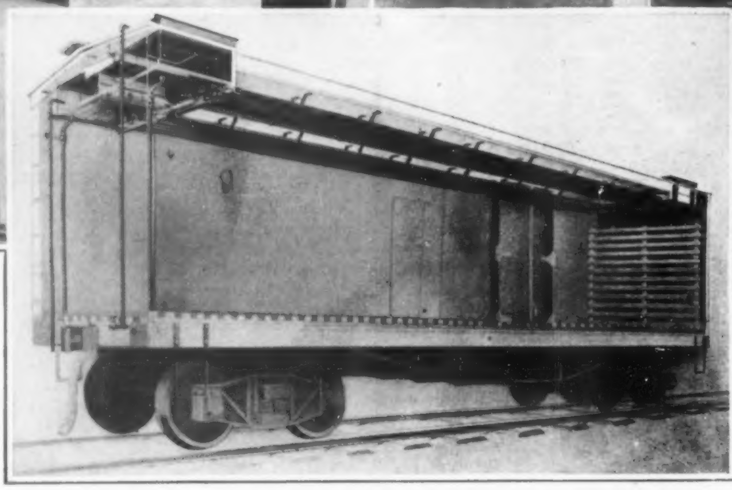
IT is difficult for us to imagine the development which science may attain in the next century and the bearing the work done in our generation may have upon it. As we read an advertised list of apparatus for sale from the laboratory of the late Sir William Crookes, we are reminded of recent efforts to again collect at least a part of the equipment used by Joseph Priestly when he discovered oxygen in 1774. How different are the two lists of apparatus! Wonder what a list made up in 2020 will contain! Perhaps in those days these furnaces, lamps, phosphoroscopes and projection lanterns used by a master scientist will again seem to have been ridiculously crude, and will again be sought out, if possible, because of what has developed from his investigations.

A Chemical Dictionary

A VALUABLE addition has been made to our American chemical literature by the publication of a condensed dictionary of chemical terms by the Chemical Catalog Company. While descriptions are necessarily brief the dictionary will be found most useful especially to those who are just learning how widespread chemistry is and that we are living in the chemical age.







Left: One of the brine tanks. *Right:* Interior of meat refrigerator car equipped with automatic circulation system. *Center:* Details of installation of automatic brine circulation system in freight car.

Some features of the automatic brine-circulation system

Refrigeration by Jolting and Swaying

THE refrigeration of freight cars and other vehicles carrying perishable commodities over long or short distances seems destined to be revolutionized by the introduction recently of an entirely new system of cooling, which has for its basis the automatic circulation of brine throughout the carrier. In fact, the value of the system has been so well demonstrated by a series of extremely rigid tests that at least one of the large Chicago packing houses has adopted it as their standard system of transit refrigeration.

The principle of the thermos bottle has been applied to the automatic brine circulation system by heavily insulating its vital parts from the rest of the vehicle. Briefly, the system consists of a tank, or two tanks connected by a series of pipes running along the top of the car, the pipes only being exposed. In each tank, which is filled with a mixture of ice and salt to form brine, is a partition running lengthwise of the car. In one of these partitions are four check valves opening to the right and in the other, four similar valves opening to the left. The result is that when the car in transit is swayed or jolted over to one side, the brine sloshes through to that side; when it is jolted the other way, the valves on the first side close while those on the opposite side open and the brine is forced through the pipes on that side. Thus there is constant circulation of the brine so long as the car is in motion and this circulation absorbs the heat units from both the car and the load. From 3,000 to 4,000 pounds of crushed ice and salt are required to charge an ordinary car, the proportion of the two materials depending upon the temperature desired in the vehicle, which, in turn, depends upon the nature of the load being carried and the outside temperature. When the car is not in motion, and is held for short periods, the power of the expanding brine is utilized for its circulation. As the heat units are absorbed the temperature of the brine exposed in the pipes is raised and causes expansion. Consequently the circulation is constant whether the car is in motion or not. For example, a car of frozen beef from Chicago to New York, June 25 to 29, stood 53 hours after arrival, with no change in the temperature at the top of the car and a rise of only one degree on the floor.

The construction of the automatic brine circulation system is such that it is not limited to refrigerator cars, but may be applied to any moving vehicle such as trucks, boats, etc. Already the system has been installed by a Chicago icecream manufacturing concern in a number of their large electric delivery trucks. In these trucks there is but one tank with pipes, through which the brine circulates and then returns to the tank. The swaying and jolting of the trucks has the same effect of circulating the brine as in the case of railroad cars.

Not the least remarkable feature of refrigerator cars equipped with this system is the fact that they may be changed from refrigerator to heater cars, or vice versa, without in any way exposing the lading. The two tanks are connected by pipes running down the end walls and along the floor, under the floor racks. When it is desired to heat the car, the over-head pipes are shut off. Water and salt are put into the tanks and the solution heated by steam from a locomotive or any available steam line to such degree as the character of the load and outside temperature conditions may require. The swaying of the moving car then circulates the warm brine through the pipes under the load in the same manner that the cold brine circulates through the upper pipes.—*Robert H. Moulton.*

This road-surfacing machine may be readily and cheaply built by the average carpenter

Home-Made Road Surfacing Machine

A COMBINATION of a spiked-tooth harrow, a drag and a smoother or slicker has been invented by D. H. Winslow, State Maintenance Engineer of the North Carolina State Highway Commission. The use of tractor-trucks in pulling the planer saves both man- and mule-power, inasmuch as formerly it required three teams and implements to do the work now accomplished by this home-made device.

(Continued on page 625)

German Aviatik in flight with 22 passengers and their luggage

Another of Germany's Giant Airplanes

GERMANY has not abandoned her wartime initiative and enterprise in the field of aeronautics, for with the termination of hostilities she was perhaps the first country to convert military machines into peace machines, and today aerial travel is established on a firm basis in most parts of the former empire.

The accompanying photograph is a rather remarkable one of a huge German Aviatik in flight. This machine is reported to be in flight with 22 passengers and their luggage. It has a wing spread of over 135 feet, is 25 feet high, and is propelled by four 225-horse-power engines. In fact, a close study of the accompanying illustration will disclose a marked similarity between this machine and the British Handley-Page of the larger, four-engine type. The arrangement of the engines, the fuselage, wings, and particularly the biplane tail are strongly suggestive of the British machine.

The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W. PAGÉ, M. S. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

A Cooperative Truck Line

CONVINCED that the time is now ripe for extending the usefulness of the truck in the field of short-haul transportation, eighty men representing business interests in Chicago and cities within a radius of fifty miles west have formed what is believed to be the first coöperative motor truck freight line in the United States. It is a purely coöperative venture, there being no promotion stock distributed within the organization.

Rail lines entering Chicago, like the most of the railroads of the country, found it difficult to transport the vast amount of freight that was dumped at their doors last spring and summer. As a consequence, unavoidable delays in the transportation of goods were frequent. It was this condition that led the manufacturers to seek relief through the organization of the motor truck as an auxiliary to overburdened railroads. Daily schedules were inaugurated between Chicago and West Chicago and intermediate points. Shortly after, routes were extended and freight stations were opened at Aurora, Elgin, Batavia, Geneva and St. Charles. As rapidly as possible, it is planned to extend the service to points within a radius of one hundred miles of Chicago. At present, the longest haul undertaken by these trucks is fifty-two miles one way.

The motor truck line has now been in operation a sufficient length of time to convince its owners and patrons alike of its merit, both as a profitable investment and as a medium for quick and economical shipment of goods. It is stated that the enterprise was a success from the start. Serving territory in which some of the largest manufacturing plants of the country are located, the truck line is giving a freight service much speedier than is possible by any other form of transportation. This is true, especially with shipments of less than carload lots. Frequently freight is placed in the hands of manufacturers within a few hours from time of shipment whereas if consigned by other carriers it might be days in transit.

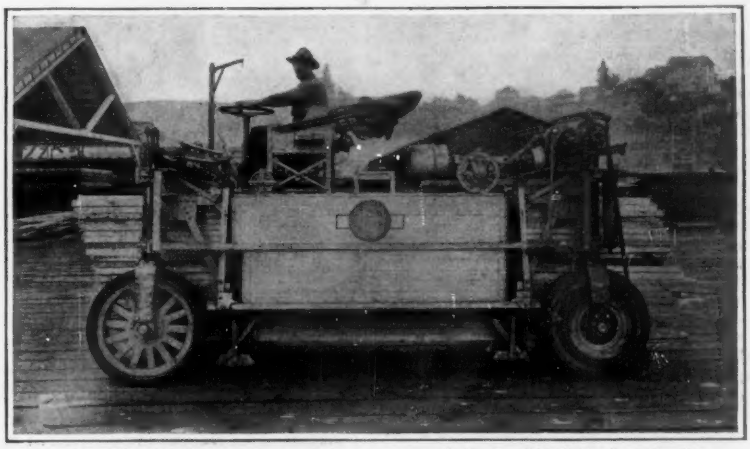
In the operation of the Western Truck Lines, railway precedents have been followed only so far as they have been found advantageous. A terminal station or depot, similar to those maintained by railroads, has been established in the heart of Chicago's shipping district. This building is a large one with 25,000 square feet of floor space. All trucks load and unload at shipping platforms arranged in station order. Depots are located in all cities through which the trucks operate, a typical station being illustrated. Each depot is in charge of an agent who assists in loading and unloading, makes out bills for freight and checks and collects bills for freight received—in fact, renders a service for the truck line similar to the duties of a local freight agent. All trucks are operated over established routes but delivery of shipments and pickup of shipments from and to points other than depots in Chicago and towns west, are made at regular published rates, the rates being based upon actual service rendered on each specific shipment.

High grade trucks are used exclusively. They are all five-ton units, fitted with bodies best adapted to highway transportation service. Comfortable cabs protect the drivers during the severest weather. Only the most skilled operators are employed, thus insuring "on time" schedules. The company has found that shippers demand a reliable service and will not tolerate irresponsible truck lines that hold out a cut rate as their only inducement for business. The line has established rates low enough to encourage shippers to use the service and at the same time high enough to justify a responsible company to give the best transportation service possible.

Station and truck of the cooperative trucking venture

Special Carrier for Lumber

WE illustrate a special form of electric truck designed especially for handling structural material such as lumber, pipe and long structural shapes. The details show many interesting features of construction. It is equipped with an elevating device that is controlled by its operator without leaving his seat and is especially constructed to run over its load and to pick the load up by power furnished by the same motor that is used for driving the machine. The motive power is storage batteries of alkaline nickel and steel construction and consists of 66 cells A-6 Edison storage batteries. These drive a motor of the usual electric vehicle type.


Truck with attachment for carrying a suspended, straddled load of lumber

The frame of the carrier consists of two inverted U-shaped members connected by girders which also support the guides. These also carry the necessary mechanism to perform the functions of transporting its loads. The batteries are carried in boxes on both sides of the carrier in easily accessible locations.

This machine was designed primarily to solve a problem that has confronted large lumber mills—that of economically taking the lumber as it left the assorting chains and delivering it to the yard, dry-kilns, planers, or any other department. As an example of what this machine can accomplish there is a record of handling 410,000 feet of lumber ranging from timber to flooring in 10 hours. It would take at least 10 horses and as many men to move this material by the horse and truck method.

The loading device consists of a cone clutch that is connected to a worm and worm gear and this through a gear reduction to two cable drums with a lead of wire cable that, through a system of cable sheaves, raises the hooks or feet that lift and sustain the load. These hooks slide up and down in guides that are hinged in a manner that permits the entire members to swing outward far enough to clear anything the wheels may pass, and are arranged in a manner that permits them to engage a load that is not central with the carrier. However, when the load is lifted clear of the ground and swings to a central position, the guides automatically lock, and remain in a rigid position until the load is set down and the locks released. The cone clutch used for the drive is operated by the same lever as the hoist and is connected in such a manner that either the driving and hoisting clutches are both out or one is in and the other out—both cannot be engaged at once.

Driving power is first transmitted to a worm-drive that is installed to serve the purpose of a jack shaft with the worm below. Through a series of universal joints the power is carried by means of sprockets and chains to the rear wheels. The wheels are carried in special fork fittings and all are turned in their steering heads when turning the vehicle. The machine as shown in the photographs has the lifting hooks incorporated between the wheels and in such a position as to distribute the weight equally on all four wheels. This, of course, necessarily lengthened the wheelbase and to offset any difficulty in handling the machine in close quarters all four wheels steer.


Another view of the straddle lumber-truck

Delivering Limestone by Truck

AT least four Ohio quarries are delivering agricultural ground limestone by motor truck. A charge of 75 cents a ton for the first three miles, one dollar up to 5 miles, and 17 to 18 cents per ton-mile beyond that distance is made by one company. Charges of from 12 to 15 cents a ton-mile are made by other firms. These concerns find that farmers prefer such delivery rather than hauling limestone themselves and also that it has stimulated a big increase in the stone business. On account of the somewhat hilly and broken country surrounding Bellefontaine, one stone company which operates such a service there, attributes its success to the use of a four-wheel-drive motor truck. With this outfit 4 tons of stone are delivered under almost any condition met. Experience of concerns at Columbus, Lima and Piqua would seem to indicate that ground limestone can be delivered by motor truck, where roads are good, at lower cost than farmers can haul it themselves by any other means. Motor truck economy is a familiar story, but it is a bit novel to find a case where hired trucks can do a job more cheaply than the horse-owner can do it for himself.

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

AERO BOMB.—F. J. CHAMBERS, care C. C. Chambers, 142 W. 126th St., New York, N. Y. This invention has for its object to provide an aero bomb having a casing in which a plunger is disposed, the plunger having a partition separating a hydrocarbon chamber from an acid chamber. When the plunger is forced outwardly by the explosion of an explosive contained in the bomb on the bomb striking an object, the acid will mix with the hydrocarbon to ignite the latter.

AIRPLANE.—C. TWINING, 39 Leonard St., Locust Point, N. J. This invention relates more particularly to means for elevating and controlling the path of movement of the airplane. The object of the invention is to provide a lifting plane, with means to operate the plane to impart vertical and longitudinal movements and to provide the plane with means whereby the downward movement will be resisted by the air, whereas the upward movement will be substantially free from atmospheric pressure.

AIRPLANE RUDDER.—C. A. STROM, Floral Park, L. I., N. Y. The invention has reference more particularly to a rudder or flags adapted to direct air current therethrough, with means of varying the position of the rudder to change the direction of the air current, whereby the direction of the machine may be controlled. Another object is to provide a single rudder which will take the place of vertical or horizontal rudders for the guiding of flying machines.

AIRPLANE.—A. G. LEIGH, care Gabriel Urwin 95 Liberty St., New York, N. Y. This invention has particular reference to certain structural features that serve to make the machine self-stabilizing. Among the objects is to provide an airplane possessing both inherent lateral stability, and inherent longitudinal stability, to increase the strength and reduce the weight, and to reduce the head resistance to a minimum, and to provide an airplane capable of alighting in a very small space, and at low speed.

Pertaining to Apparel

BELT GUIDE AND SUSPENDER SUPPORT.—J. FRYE, 28 Cottage Place, Bridgeport, Conn. The principal object of the invention is to provide a combined support serving the double function of properly guiding and holding the belt and providing means on which the suspender may be engaged, thereby doing away with the use of buttons. Another object is to provide a guide and support which is made of wire, and which may be attached without the use of thread or special tools or instruments.

Electrical Devices

RESERVE DRY CELL.—A. LANDAU, 42 Broadway, New York, N. Y. This invention relates to a dry cell of that type in which the consumer supplies water thereto, whereby an electrolyte is formed to produce current when the cell is connected in an electric circuit. The object is to so construct the cell that water is supplied to the cup at a point outside the bibulous lining, and the water percolates inwardly through the lining and mix to the central carbon electrode, which insures quicker and more uniform action on electrodes, and maximum efficiency is secured.

METHOD OF OBTAINING SPARKLESS BREAKS OF ELECTRIC CIRCUITS.—T. F. WALL, Edgbaston, Birmingham, England. The object of the invention is to supply a method of insuring a sparkless break in a circuit comprising an inductance and a source of alternating electromotive force in series therewith, which comprises closing the circuit when the alternating electromotive force is substantially zero, impressing an auxiliary uni-directional electromotive force thereon of such value as to cause the current to pass through zero at substantially the same time as the impressed electromotive force and interrupting the circuit at the time when both current and electromotive force are passing through zero.

Of General Interest

DRAFT APPARATUS.—J. LAMON, Le Roy, Minn. The invention has for its object to provide apparatus, adapted for use with eveners and whiffletrees, wherein eyes for engagement by the double trees, swingle trees or tugs are connected by a truss so arranged that the greater the pull on the eyes the more firmly the truss is anchored.

GENERATOR.—L. M. N. WISE, 312 Rebecca St., McKeesport, Pa. This invention relates to gas generators. An object is to provide a generator, adapted more particularly for generating gas under extremely high pressures, one of the foremost principles of the invention residing in the means for equalizing the gas pressures in the fluid and chemical containers.

WRIST WATCH STRAP.—B. R. JOLLY, 51 Maiden Lane, New York, N. Y. The object of this invention is the provision of a construction which will not only hold the watch properly in place but which may be contracted and enlarged as desired while maintaining a ring structure so that it cannot be accidentally lost off the arm. Further objects are to provide a strap which may be adjusted to produce a comparatively large loop, and a wide strap to contact with the wrist when in use and a small retaining strap for holding the watch.

DISPLAY DEVICE.—S. MITTLEBURG, 257 W. Federal St., Youngstown, Ohio. The invention has for its object to provide a frame having an opening with one or more shelves hinged to the frame at the opening, the shelves being supported by a standard when in a horizontal position, and serving as a panel when moved to a vertical position in the longitudinal plane of the frame.

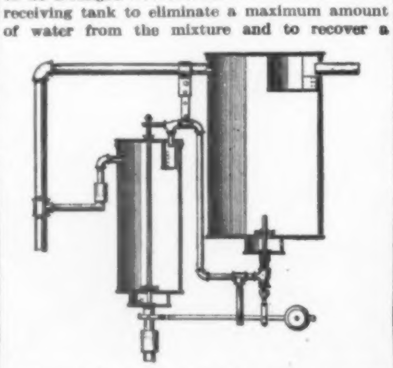
STEREOPTICON SLIDE.—T. M. WATSON, 482 Prospect Place, Brooklyn, N. Y. This invention relates to slides for stereopticon projectors, and has for its prime object to provide means for use in connection with glass plates to permit of their use with high power projectors. The invention provides a holder, the use of which, permits a free circulation of air between the plates of the slide, and at the same time provides for expansion of the glass when subjected to high degrees of temperature.

REGULATING DEVICE FOR THE FLOW OF LIQUID IN ORDNANCE-BUFFERS.—E. RIMAILHO, Paris, France. The invention relates to regulating devices for the flow of liquid in the ordnance-buffers. The device which is the subject of the invention realizes accurately the regulation of the flow of the liquid in an ordnance-buffer according to the angular displacements imparted to the gun by automatically varying the area of the flow orifice. Said device may be equally adapted to a hydraulic buffer or to a hydropneumatic buffer, in which the liquid at rest is under pressure or not.

FUSE FOR HAND GRENADES AND OTHER EXPLOSIVE ENGINES.—J. PABAN, St. Ouen, France. The present invention has for its object the process of making the body of a fuse and affixing it to the fuse cord which it is to inclose, which process consists in casting the material that is to constitute the body directly around and upon the said fuse cord.

SPRAYING DEVICE.—A. E. HALBERT, R. F. D. 7, Battle Creek, Mich. The invention has particular reference to that type of device adapted for connection to or use with a flexible hose whereby there may be mixed with the water being sprayed a solution of any desired nature such as insecticide, fungicide or fertilizer, the device includes a valve for controlling the flow of water, and a compression chamber out of which and into the current of water any suitable chemical is adapted to be forced for mixture with the water.

OIL AND WATER SEPARATOR.—J. F. GOUCHENOUR, Greybull, Wyo. The object of the invention is to provide a separator adapted to be arranged between the condensers and the receiving tank to eliminate a maximum amount of water from the mixture and to recover a



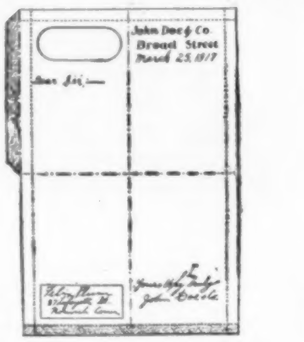
A SECTIONAL VIEW SHOWING THE SEPARATOR

maximum amount of oil, wherein a balanced trap is provided, controlled to discharge by excess of water in the trap, and wherein the feed of the mixture to the trap is also controlled by excess of water in the trap.

NAPKIN RECEPTACLE.—J. MITCHELL, care Cotton Belt Saving and Trust Co., Pine Bluff, Ark. This invention relates to receptacles for napkins, glasses, menu-cards, and the like, and has for an object to provide a form of clamp adapted to be clamped to a counter or other support arranged with a slide connection between the clamp and the receptacle to be supported thereby, whereby the receptacle may be removed without removing the clamp.

SMOKER'S POUCH.—F. GOERTZ, 505 Fifth Ave., New York, N. Y. The invention has for its object to provide a pouch having a body which is normally closed by a slidable head, there being means to prevent the complete removal of the head under normal conditions, although permitting the withdrawal a sufficient distance to enable the user to obtain a cigarette paper and matches from compartments in the head, and also to expose an opening in the body through which tobacco may be fed.

COMBINED WRITING SHEET AND ENVELOP.—R. E. ALTOONIAN 345 Fourth Ave., New York, N. Y. This invention has for its object to provide a combined writing sheet and envelop which is so fashioned that it is adapted



A PLAN VIEW OF THE INVENTION

to be folded transversely and longitudinally and with an inclosed space for the address that the address used in mailing the envelop will appear on the same side of the writing sheet as the letter, a margin at one end and a flap at the side being provided with an adhesive, for closing the envelop.

MILK DISPENSING APPARATUS.—D. B. RYAN, 2874 Hart Ave., New York, N. Y. The invention relates to measuring and dispensing devices, and has for an object the provision of a construction for simultaneously measuring and dispensing milk in a sanitary manner. Another object is to provide a vending device for milk which will act as a stiring device as well as a vending device and in which the vended milk may be discharged at substantially one time or in small quantities.

COMBINED ADVERTISING MEDIUM, CASH VOUCHER AND TICKET.—W. H. ALBERT, 120 Broadway, North Caldwell, N. J. The object of the invention is to provide a combined advertising medium, cash voucher and ticket more especially designed for use by railroads and other transportation companies, or by theatres using tickets for admission, the advertising medium being arranged to enable the patrons to obtain a predetermined cash discount on each ticket bought, and to enable the advertiser to reach a large number of persons at a comparatively small cost and to make it remunerative to the issuing concern.

PROCESS FOR CONTINUOUS DEFECATION OF SUGAR SOLUTIONS.—G. B. WILLIAMSON, Gramercy, La. The object of the invention is to provide a process of continuous defecation of sugar solutions and which is characterized by the treatment of sugar solutions with heat, lime, phosphoric acid or sulfurous acid gas and air. The process consists in treating the solutions with defecants, then aerating the solutions by bubbling air through them, and then heating the solutions to cause the impurities to rise to the surface.

FILL BOX FOR STORAGE TANKS.—M. J. SAGE, 781 Union St., Brooklyn, N. Y. The invention relates to boxes placed on street corners to give access to the storage tanks, such as are provided underground in gasoline stations. An object is to provide a simple and convenient box which is provided with a strainer through which the fluid is caused to pass before it can enter the storage tank.

PORTABLE POTATO-BIN.—H. H. HOOPS, 72 18th Ave., Long Island City, L. I., N. Y. The general object of the invention is to provide a bin, a side of which is adapted to be lowered and to receive thereon a sack of potatoes or the like, means being provided to grip the bottom of the potato bag so that the side may be raised to constitute a closure of the bin and permit the potatoes to gravitate into the bin. The invention includes a slatted bottom through which dirt and smallest potatoes may pass into a drawer.

ROOF FLASHING.—F. E. GROSVOLD, address A. H. SHOEMAKER, Eue Claire, National Bank, Eue Claire, Wis. The invention relates more particularly to a roof flashing so formed that it may be adjusted to vary the angular relation between the tubular body of the flashing and the plane base, whereby to accord with the slope or angle of the particular roof to which the flashing is applied.

TRENCH KNIFE.—R. HUGHES, Bedford Hills, N. Y. The invention relates to weapons, the object being to provide a trench knife used in offensive and defensive warfare, consisting particularly of a knife blade mounted in a hasp and secured to the back of the hand by a strap, thus leaving the palm of the hand open with the fingers free to grasp an object, the blade closes in a location out of reach of the fingers thus entirely removing the liability to accidentally catch and cut the fingers.

PLASTER COMPOSITION.—L. V. ECKERT, Chillicothe, Mo. The object of the invention is to provide a plaster composition capable of being marketed in the dry state ready for mixing and requiring only the addition of water wherein sand is dispensed with, the binding being provided by fibrous material in the form of ground straw or straw meal. The straw meal provides a consistency to the finished plaster which is not found in sand and which causes it to adhere closely to wood, metal, brick or the like when used as a finishing coat.

COLLAR BUTTON.—J. W. BARGER, Danville, Ill. The invention has for its object to provide a construction to facilitate the insertion of the head of the button in the button-hole of a collar, and a neck band. To accomplish this result the thickness of the head of the collar-button is reduced to such an extent as to relieve the necessity of spreading the button hole, and to greatly reduce the friction in slipping the necktie along the button head.

BUDDING CLASP.—V. TOLLIS, care C. W. STUART & Co., Newark, N. J. The invention relates to budding clasps for trees or bushes, and has for its object to provide a clasp, for holding closed the wound or matrix in the budded stock, wherein a single clasp capable of being opened with one hand and spring closed, and having means for gripping opposite sides of the stock, above and below the bud.

CONTAINER.—I. T. SMITH, R. 725 Singer Bldg., Broadway, New York, N. Y. The principal objects of the invention are to compel a person opening a bottle to pay particular attention to the bottle, the invention has particular reference to bottles containing dangerous or poisonous ingredients, the bottle is sealed in such a manner as to necessitate an alert act on the part of the person desiring to open the bottle, and thereby accidental misuse of its contents is avoided.

REINFORCE FOR SHIRTS.—Y. K. BUELL, Box 926, City Hall Station, New York, N. Y. The object of the invention is to provide a reinforce for negligee and other shirts, arranged to reinforce the neck portion, thereby protecting this portion against being easily worn through

FRONT ELEVATION OF A SHIRT PROVIDED WITH THE REINFORCE

by contact with the collar. The reinforce being made of the same material as that of the shirt, and extending all around the neckband, made in separate pieces, two for the front under the shirt body and one for the back under the plies of the yoke.

(Continued on page 616)

Recently Patented Inventions

(Continued from page 614)

SIGHT FOR FIREARMS.—H. W. Holden and H. M. Pendleton, address H. W. Holden, Durham, Conn. The invention relates to front sights for rifles, guns and other firearms, its object is to provide a sight arranged to permit convenient adjustment, and to allow of securely fastening the adjusted sight on the barrel. The invention comprises a body provided with a base adapted to engage a guideway, clamping means slidable in the base, and a screw engaging the clamping means to force the latter into contact with the guideway to fasten the sight in place.

GATE.—I. R. Burkholder, Lancaster, Pa. The invention particularly relates to pull gates which may be opened and closed from either side and at points distant from the gate setting proper, flexible connections leading to the gate operating means from such distant point, the primary object of the invention is to provide a connection with the generally well known gate for the purpose of promoting better and more effective operation.

STILL.—G. L. Rowsey, Humboldt, Kans. The object of the invention is to provide a still particularly adaptable for the continuous distillation of liquid hydrocarbons, whether under ordinary or high pressure and at any desired temperature. The still is of the tubular type having arcuated sections which permit proper expansion of the parts submitted to different temperatures, thereby reducing strain. Another characteristic is the disposition of the heated tubes whereby the separation of the lighter and heavier hydrocarbons is facilitated.

BARREL FASTENING FOR FIREARMS.—W. E. Rosebush, Appleton, Wis. The invention relates to recoil operated breech loading hand firearms. The object is to provide a barrel fastening for firearms arranged to permit the user to conveniently and quickly remove the barrel from the barrel receiver for repairs or for using barrels of different size bores on the same firearm.

COMPOSITION FOR PREVENTING SMUT IN PRINTING INK.—P. S. Byrne, care Printing Ink Compound Co., 163 W. 29th St., New York, N. Y. The invention relates to a mixture which when added to printing ink will prevent what is termed "offset or smut." An object is to dispense with the delay in printing by introducing into the ink a mixture formed of tallow, varnish, starch, paraffin oil, and oil of citronella, which will cause the same to set rapidly and thereby prevent smut.

CLAMP FOR HOISTING ROPES.—J. J. K. Kougham, 2531 Martinez Ave., Berkeley, Cal. This invention relates to a hook for clamping hoisting ropes used for handling freight, the device

A SIDE ELEVATION OF THE CLAMP COMPLETE AND IN USE

being particularly serviceable on ship board and in warehouses. The device comprises a slotted link and a hook pivoted therein, both the link and hook being provided with extensions adapted to clamp the rope when properly adjusted thereto.

COOKING UTENSIL.—A. H. Brunner, Marion, Ill. The object of this invention is to provide a device adapted for cooking orders of oysters, potatoes or the like, wherein a support is provided, and a series of baskets of perforate material, each adapted to contain an order of oysters, potatoes, or the like, which may be lowered into the fat to cook, and which may afterward be removed to permit the fat to drain from the contents.

GUN SIGHT.—W. Elliott, Marshfield, Ore. The invention has for its object to provide a gun sight wherein the sighting element is adjustable vertically with respect to the gun, and wherein the sight is detachable to permit the use of different types of sights, grooves are provided for supporting the sight pins, and a locking device engaging the grooves to hold the pins in adjusted position.

RECORD INDEX.—A. West, Blackwell, Okla. The invention has for its object to provide a device in the form of an envelop especially adapted for disk records, this envelop carries on the front a label which gives the title of the selection, and has lines which partially separate this label and the portion of the envelop which carries the same from the remainder. The lines of perforation are spaced outwardly from the ends and sides of the label, in order that when this portion of the envelop is detached, the label will have a margin sufficient for binding.

CAN OPENER.—H. E. Hoke, Hanover, Pa. An object of the invention is to provide a can opener including a pair of pivoted bars having a centering prong for centering the cutter in the middle of the can, and providing a pivot, the blade carrier being slidably mounted, and a stop cooperating with the cutter blade for spacing the cut an even distance from the rim of the can.

POWDER BAG, P. R. Bradley, care L. A. Hartshorne, 120 Broadway, New York, N. Y. This invention relates to powder bags for use for the explosive charge for cannon or large guns. The object is to provide a substitute for silk bags which will not blaze, flame or spark, and yet will permit of raped ignition of the charge from the flame of the primer, the substitute bag being of comparatively cheap fiber, such as cotton, jute, flax, linen or the like, which can be had in unlimited quantity in this country, and can be fabricated.

WRIST WATCH.—C. F. Trommer, 30 W. 36th St., New York, N. Y. Among the principal objects which the invention has in view are, to facilitate the operation of installing and removing an article of the character mentioned in service, to avoid loss of the article and to coordinate the elements of the construction for improving the appearance of the article. The watch case is furnished with lateral extensions, the extensions having hinge knuckles suitably arranged to form an encircling means.

LOOM FOR BEADWORK.—D. Traum, 925 Tiffany St., Bronx, N. Y. The invention relates particularly to a weaving loom for supporting in taut condition the plurality of parallel spaced work threads of woven bead work. An object is to provide a loom frame with means for holding considerable lengths of warp threads so that very long strips of bead work can be woven without removing the work, means are also provided for winding up or disposing of the woven bead work as it is completed.

GAS MASK AND RESPIRATOR.—N. Schwartz, 15 Fort Washington Ave., New York, N. Y. The object of the invention is to provide a mask and respirator arranged to snugly fit the face of the wearer and to prevent gases, dust and other extraneous matter from reaching the mouth, nostrils or eyes, at the same time enabling the wearer to breath freely. Another object is to make the body of the mask and respirator mainly of textile material thus eliminating sheet rubber or similar material liable to deteriorate under the influence of certain gases.

COPY HOLDER.—E. Graham, Wray, Col. Among the objects of the invention is to provide a copy holder comprising a hollow cylindrical casing, having two parts hinged together longitudinally of the casing and having means to hold the parts closed but with the sheet or sheets being copied projecting radially from within the casing along the joint or meeting line of the two casing parts, while the bulk of the matter is housed within the casing.

DEVICE FOR FEEDING BUFFERS FOR ORDNANCE WITH LIQUIDS.—E. Rimailho, Paris, France. The object of this invention is to provide a device for feeding buffers for ordnance with liquid, in which ready and perfectly tight communication between the feeding pump and the buffer is obtained. One of the features of the device is the provision, around the pump-body, of a chamber rendered perfectly tight by means of a mounting of joints; into this chamber discharges the exhaust valve of the pump-body, and the feeding channel of the buffer leads therefrom.

ANIMAL POKE.—B. F. C. Morris, El Reno, Okla. The invention has for its object to provide a simple device of the character specified, that will effectually prevent the animal wearing the same from passing through, under or over fences, and wherein a collar is provided that will prevent dislodgement of the poke, while at the same time will not interfere with the legitimate movements of the animal, as in grazing, drinking or the like. The device fits so far forward that the animal cannot get its feet to the fence.

SHIP PROTECTOR.—A. Reed, Roland, Okla. The object of the invention is to provide a device adapted to engage and deflect or explode a torpedo or mine before the same can strike the hull of the vessel. The protector is made in sections, of rotatable reels supported in spaced relation and on opposite sides of the vessel for deflecting mines or torpedoes, there are propellers in connection with the reels, and means for rotating the reels and propellers.

DEVICE FOR USE IN CUTTING BEANS.—O. J. Tubbs, Waterville, Me. This invention relates to means for cutting string beans and has for its general object to provide a device wherein the beans may be deposited and alined for trimming at one end, together with means for repeating the operation with respect to the opposite end, and means for holding the trimmed beans constituting a movable gage for determining the cutting of the beans into uniform lengths.

MAGNESIUM LAMP FOR PHOTOGRAPHIC USE.—J. P. Hansen, Copenhagen, Denmark. The invention concerns a magnesium lamp in which for ignition of the light producing power, an ordinary match is used. The lamp is small, collapsible, and may be carried in an ordinary coat pocket. The device comprises a lamp body, a slidable match holder, igniting surfaces removably secured to the lamp body in front of the match holder between which the match extends and means for sliding the match holder.

CHANGEABLE SIGN.—J. W. Thoreau, Geddes, S. Dak. An object of the invention is to provide a sign adapted more particularly for use in show windows, although not limited to this field. One of the features of the device being the ability to make innumerable color and display combinations by use of suitably made insertible letters and devices, the tangs or projections of the insertible letters, proving supports to prevent the letter bearing plates from being disarranged.

BUCKLE.—H. J. Wilton, 2717 Third Ave., N. Seattle, Wash. The invention has for its object to provide a buckle especially adapted for connecting the ends of a belt, wherein the buckle is formed of resilient material, shaped to form an open loop, one end of which is engaged by one end of the belt, the other having means for clasping the other end of the belt, and having means for limiting the movement of the clasping means.

AUTOSELECTIVE FUSE.—J. W. Taylor, 1128 Foulkrod St., Philadelphia, Pa. The object of the invention is to provide mechanism in connection with the striker or plunger mechanisms of artillery fuses, for neutralizing the elastic energy of the recoil, to prevent the premature action of the striker or plunger, to neutralize the elastic energy a shock pad is introduced to protect the striker.

CASEIN DRYING APPARATUS.—J. F. Dietrich, Kennewick, Wash. One of the principal objects of the invention is to provide a device by means of which the casein may be dried quickly and thoroughly, due to the fact that it is subjected to a current of warm sterilized air during the drying process, thus effecting the extraction of moisture without in any way endangering the quality of the product, the device having means for preventing the burning of the casein during the drying process.

Hardware and Tools

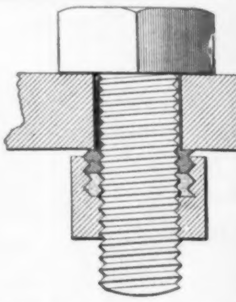
COMBINATION LOCK.—W. H. Jay, Mobridge, S. Dak. The invention relates particularly to a combination lock for doors and other places, more especially those employing a bolt throwing member actuated by the door knob. The prime object is the provision of a simple device capable of manual control and in which the necessity of carrying the key is avoided, thus rendering the device particularly desirable in hotels and the like.

COMBINATION PADLOCK.—S. Shaler, 493 E. 173d St., New York, N. Y. Among the objects of the invention is to provide a padlock having a frame or body, a removable shackle and a plurality of finger operated tumblers constituting the means for locking, said tumblers being provided with index characters serving to establish the proper combinati whereby theon shackle may be removed when the tumblers are set in a predetermined position.

LOCK NUT.—J. G. A. Goedhart, Amsterdam, Netherlands. The invention relates to lock nuts of the kind in which the nut is provided at its end face with an eccentric projecting lug, and the locking key is provided with peripheral threads, spaced so far from one another as the pitch of the threads of the nut amounts to characterized by the end face of the nut between the lug and the nuthole being curved according to a screw line of pitch not less than the pitch of the threads of the nut, thus leaving a space between the lower end of the inserted locking key and the end face.

PIPE HANGER.—N. J. Wheeler, 1733 N. 12th St., La Fayette, Ind. This invention relates generally to pipe hangers, and more particularly to adjustable pipe hangers, the object being the provision of a construction wherein vertical adjustment of a pipe hanger may be provided for in a simple and convenient manner so that suspended pipes carried thereby may be either leveled or the desired slope thereof brought about.

LOCK NUT.—J. A. Schofield, United States Navy, Washington, D. C. One of the principal objects of the invention is to utilize a soft ring of ductile material in connection with a hard com-



VIEW SHOWING A NUT AS INVENTED IN SECTION

pression ring, both contained in the nut, for securing a binding action between the threads of the compression ring of the nut and the bolt, and in addition, a binding action of the soft ring about the threads of the bolt, retaining the nut in such a manner as to prevent its backing off.

WIRE BENDER.—S. M. Johnson, Middlefield, Ohio. This invention has for its object to provide a device especially adapted for forming the loops or eyes on bails, wherein a disk is provided, having pins extending laterally therefrom for engagement by the wire to bend the same when the disk is rotated, the device having a guide for facilitating the engagement of the wire with the pins, and means for limiting the movement of the wire.

TOOL FOR REMOVING CONNECTIONS FROM BATTERIES.—F. S. Kay, address W. S. Sayers, Hill City, Kans. The prime object of the invention is to provide a tool whereby connecting strips of storage batteries may be removed from the posts of the groups of plates in such manner as not to destroy the posts and to accomplish the removal of the strips without injuring the latter so that in repairing the battery the same connecting strips may be replaced on the original posts and secured thereto in the usual manner.

GUIDE OR GAGE FOR HAND TOOLS.—H. Briggs, 244 Walter Ave., Hasbrouck Heights, N. J. The invention relates to a guide or gage for hand tools which, in operation, are reciprocated in straight lines such as files, saws, etc. More particularly the invention relates to a guide to be applied to a triangular file used for sharpening the teeth of saws. An object is to provide such a guide which will indicate the desired angular position of the line and which may be conveniently used as a hand-hold in the operation of the tool.

LATCH.—A. Maurer and F. J. Von Kaentzel, address A. Maurer, 381 Cometia St., Brooklyn, N. Y. The invention relates particularly to a latch or lock adapted to be used on lockers, cupboards, and the like. The device is of the type in which a casing adapted to be secured to the door has a manually slidable latch bolt adapted to engage in a keeper applied to the frame or jamb. The slide bolt and the relatively fixed keeper having members adapted to be brought into register for receiving a padlock or the like for locking the door.

Heating and Lighting

THERMOSTATIC STEAM TRAP.—D. N. Crosthwait, Marshalltown, Iowa. The object of this invention is to provide a device wherein the proportionate amount of water of condensation passed by the trap is constant, under varying conditions of temperature or pressure, and wherein the rate of flow may be increased with an increase of pressure and a uniform or graduated opening may be provided for the same drop in temperature between that corresponding to the pressure of the steam and the temperature of the water of condensation entering the trap.

Machines and Mechanical Devices

MACHINE FOR WAXING SHEETS OF CIGARETTE PAPER.—G. Gascard, Paris, France. The subject of this invention provides a machine which by reason of its special construction offers the advantage of assuring a large output and, moreover, a perfectly regular and even application of the paraffin wax whatever may be the quality of the paper even when the latter is not well calendered. The sheets to be waxed are automatically fed one by one from a pile, as in printing machines.

SINTERING MACHINE.—W. M. Davison and G. C. Riddell, Port Pirie, South Australia, Australia. This invention relates primarily to grates for use with roasting and sintering ma-

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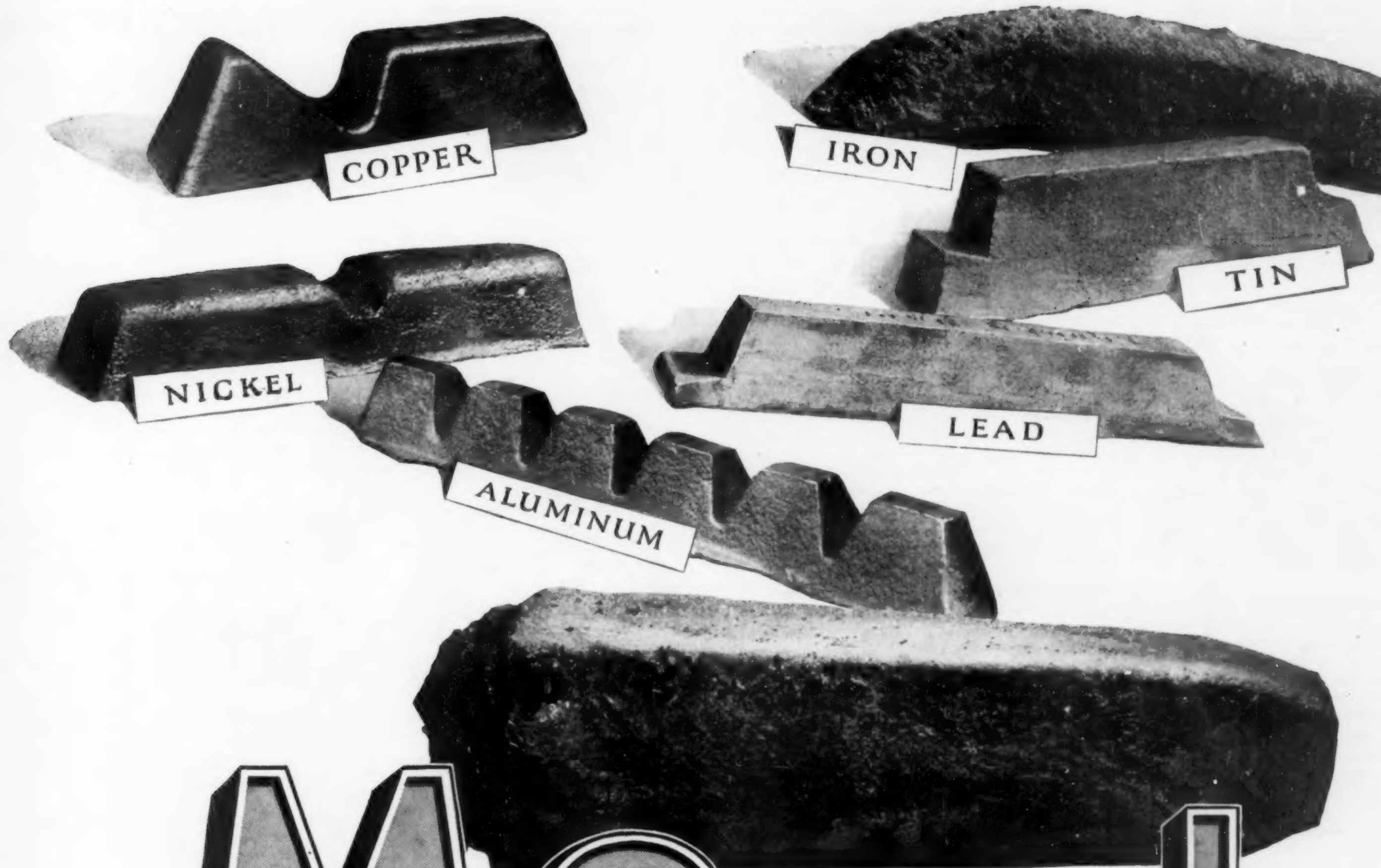

COPPER
IRON
TIN
NICKEL
LEAD
ALUMINUM

Recently Patented Inventions

(Continued from page 616)

chines of those types which employ traveling grates, which are liable to become clogged in the air spaces; and also to devices for use in connection therewith for the purposes of cleaning from the grate any of the sintered material which may cling thereto and so clog the grate and particularly the spaces between the bars.

SAND AND GRAVEL PUMP.—J. A. POLLARD, Oakland, Miss. The invention relates to a construction wherein air is utilized in removing sand and gravel from a well. An object is to provide a pumping apparatus in which sand and gravel may be removed from a bed beneath the surface of the earth in connection with the water contained therein by the use of intermittent blasts of air into the sand and gravel at the proper point.

AUTOMATIC SELECTIVE TEMPERATURE CONTROLLER.—H. W. and R. H. SOUDER, 241 E. Mauch Chunk St., Tamaqua, Pa. The invention relates to Patent No. 1,204,909 issued to the same inventors November 1916. The objects of the present invention is to improve the means for maintaining the clock mechanism in running order automatically, to improve the disk associated with the clock, whereby the same is rendered more easily adjusted for variations in times of operation of the day and night thermostats.

MAGNETIC TRANSMISSION GEARING.—J. T. RONAN, Ludwig, Nev. The object of this invention is to provide a magnetic gearing of relatively simple construction, in which the few parts cannot readily get out of order. A further object is to provide a device of the type described having a simple electrical control circuit.

VALVE.—T. B. FORD, 407 Broom St., New York, N. Y. The invention relates to valves for controlling steam, water, or other liquids and gases, its object is to provide means whereby a valve seat that has become defective can be readily removed or interchanged without requiring alteration of the valve body. Another object is to eliminate corrosion due to the effect of water especially salt water on the joint between the valve seat and the valve seat opening in the web of the valve body.

CRANE.—H. N. NELSON, First National Bank, Northwood, N. D. The object of the invention is to provide a device especially adapted for lifting wagon bodies, racks, and the like from the running gear of wagons, and for replacing the same on the running gear wherein the crane as a whole is easily transported from place to place and easily operated to remove or replace the body or rack.

SAWING CARRIAGE.—P. J. HILL, Box 242, Mystic Conn. The invention relates to a short log sawing carriage and an automatic dog whereby logs may be sawed on one or two sides easily and rapidly. An object is to provide a carriage and saw structure wherein a log placed in the carriage manually is automatically sawed and released; provision is made for sawing two slabs from the log for producing a railroad tie or four slabs to produce a square in cross section.

AUTOMATIC TEMPERING MACHINE FOR TOOLS.—C. O. STEE and K. H. KOLHEDE, care Corro de Pasco Copper Corp., Cerro de Pasco, Peru. This invention relates generally to the tempering of steel tools or tool steel, such as rock drills and the like, the object being the provision of a simple apparatus which will automatically release for plunge into a quenching fluid when the temperature of the steel placed therein has reached just the desired point, whereby the tempering operations will be uniform.

LENS GRINDING MACHINE.—H. KRIEGER, care Jena Optical Co., 140 E. 24th St. New York, N. Y. The object of the invention is to provide a lens grinding machine more especially for grinding toric lenses and arranged to grind a large number of lenses at one time, without requiring any attention on the part of an operator. Another object is to permit of making convenient and accurate adjustment for grinding lenses of different curvature, and of different width.

TRANSMISSION MECHANISM.—A. WORPITZ, 200 W. 89th St., New York, N. Y. Among the principal objects which the invention has in view are to provide for shifting a worm-driven transmission gear to vary the effect thereof, to furnish a worm-driven transmission gear wherein the worm wheel is altered to conform with the worm gears of various pitch, to adopt a single worm wheel for cooperating with a series of worms, to reverse the transmitted direction of a worm gear.

Medical Devices

ETHER CONE.—E. G. BAUM, 21 W. Central Ave., Natick, Mass. An object of the invention is to provide a surgical device to be used in particular for administering ether. The prime object is to provide a cone which may be quickly assembled, and which comprises a set of metal fittings used in connection with ether administering means so that the portions of the appliance which come in contact with the patient may be destroyed after use, while the permanent metal fittings may be sterilized for continual use.

Musical Devices

PHONOGRAPH RECORD.—L. S. HOLMBOE, 311-15 Majestic Bldg., Oklahoma, Okla. An object of the invention is to provide a phonographic record having one or a plurality of radiating slots in the center, with pin holes for receiving a pin, both slots and pin holes being employed in cooperation with a record changing mechanism. Another object resides in the formation of the sound groove on the surface of the record which includes blank portions at the beginning and the end.

PHONOGRAPH NEEDLE.—E. T. CHERNUSHEK, 17 Stone St., New York, N. Y. Among the objects of the invention is to provide a needle and a peculiar holder for the same providing for the use of a single needle for the playing of a vast number of records without removal. A further object is to provide a phonograph needle which may be adjusted from time to time so that a single needle will last for the satisfactory playing of thousands of records, but which when eventually worn out may be replaced by another of the same type.

Prime Movers and Their Accessories

REVERSIBLE FOUR-CYCLE ENGINE.—J. KEISTER, Steubenville, Ohio. An object of the invention is to provide an engine of the single sleeve reciprocatory valve type which has only one aperture for the inlet of the explosive charge and the outlet of the spent gases, there being a valve device for controlling the admission of the mixture to the port of the sleeve valve and the outlet of the exhaust gases.

LUBRICATING SYSTEM.—H. L. FISHER, Brandon, Manitoba, Canada. This invention relating to lubricating systems, has for its object to provide a system especially adapted for internal combustion engines, for thoroughly lubricating the crank shaft and the pistons, wherein the lubrication is brought about by the movement of the crank shaft, the crank shaft, the piston rod and the crank pin having communicating passages for conducting the oil.

HEATER FOR INTERNAL COMBUSTION ENGINES.—L. H. BELL, Paublina, Iowa. The invention relates to heaters for internal combustion engines and has for its object to provide a device capable of attachment to the manifold of the engine and inclosing the exhaust pipe for deflecting the air surrounding the exhaust pipe and heated thereby downwardly onto the manifold.

PISTON RING.—F. D. BLAUVELT, 247 9th Ave., New York, N. Y. This invention has particular reference to a composite piston ring formed of a plurality of rings coacting to produce a tight packing piston ring. An object is to provide a ring particularly adapted for internal combustion engines subject to high compression such as crude oil, kerosene, gasoline, etc. A further object is to provide a ring which will take the place of a plurality of piston rings used at present.

Railways and Their Accessories

SCALE.—G. H. KAISER, Portland, Ore. The invention relates to scales of that character used on railroads, having removable pivots and bearings, the special object of the invention being to provide a means for holding the pivots and bearings firmly in place, but in such manner that they may be removed when desired.

Pertaining to Recreation

TOY FLYING MACHINE.—A. S. FERGUSON, Springfield, Mo. The invention relates to a toy flying machine adapted to be swung through the air at the end of a string. An object is to add to the attractiveness of the toy by providing for the connection of the string with the machine in a manner whereby the centrifugal force generated by the whirling of the toy through the air will cause the toy to assume an angle varying with the speed, to thus simulate the flight of an actual machine moving in a circular path.

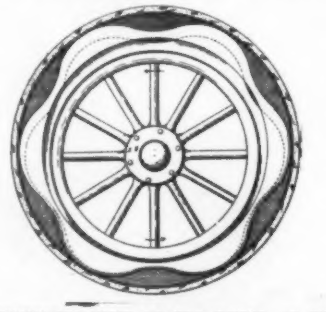
TOY AIRPLANE.—E. F. LONERGAN, Millburn, N. J. The object of the invention is to provide a toy airplane more especially designed to simulate or represent a modern battle plane. Another object is to provide a toy airplane which is simple and durable in construction, the propeller being turned by a spring motor; the device being cheaply manufactured can be placed on the market at a comparatively low cost.

MOVING PICTURE TOY.—W. A. ADAMS, 110 W. 40th St., care World Syndicate Co., New York, N. Y. Among the principal objects of the invention are to furnish an amusement device adapted to have a portion thereof renewed from time to time to obtain a variety of effects, to provide a device adapted to receive a variety of sets of pictures serially progressive for exposure in simulation of moving pictures, and to obtain the effect of rapid action acting obscuration shutters without employing the same.

GAME BOARD.—C. A. GEIB, 634 Morris Park Ave., Van Nest, Bronx, N. Y. This invention has particular reference to a game board having a peculiarly arranged set or series of pits and valleys merging thereinto with all rounded smooth surfaces for cooperation with one or more balls. A further object is to provide a board for a rolling ball game, with a field of depressions all so designed as to make it impossible for the ball to rest finally outside one or another of the depressions.

Pertaining to Vehicles

AUTOMOBILE WHEEL.—A. W. ALTHOFF, 308 East First St., Tulsa, Okla. This invention relates to wheels of the floating-hub type, an object being to provide a wheel which will absorb shock. The outer rim of the wheel is provided on its inner surface with a channel in which the edge of the inner or floating portion movably fits, the channel being fitted with thick, specially prepared lubrico to absorb shock. An extra compartment

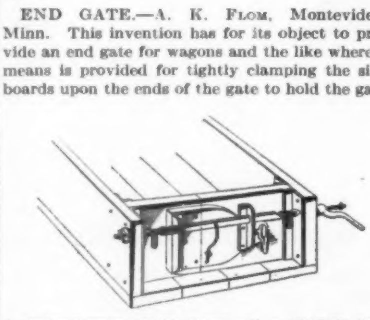


A PERSPECTIVE VIEW OF THE WHEEL AT REST

in the rim carries the over-compression of the movable substance supply and accentric movements of the inner floating portion places the supply again in communication within the channel. Another feature is a tread composed of traction plates or blades with a concrete material interposed between them.

DEMOUNTABLE RIM.—G. KNOWLING, Jr., address, S. J. Foot, Water St., St. Johns, Newfoundland. The object of the invention is to provide means for locking the rim on the wheel body. Another object is to provide a demountable rim which can be easily and quickly removed from the wheel body, and which is equipped with locking wedges normally retained in position by yielding means, and which prevent an axial movement of the demountable rim on the wheel body.

END GATE.—A. K. FLOM, Montevideo, Minn. This invention has for its object to provide an end gate for wagons and the like wherein means is provided for tightly clamping the side boards upon the ends of the gate to hold the gate



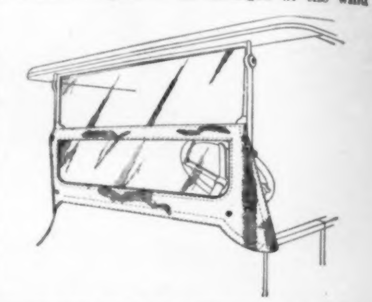
A PERSPECTIVE PLAN VIEW OF A WAGON BOX SHOWING INVENTION AS APPLIED

in lowered or partly raised position, and by means of which the boards may be held from spreading when the gate is not in place.

SHOCK ABSORBER.—E. P. THOMAS, Centralia, Wash. An object of the invention is to provide a shock absorber with a form of valve for controlling the passage of a fluid from a cylinder through ports leading to a by-pass, the valve being operable from without the shock absorber. Another object is to provide means for connecting the shock absorber with parts of a vehicle.

VULCANIZING DEVICE.—D. E. BOOTH, Box 1728, Tulsa, Okla. A purpose of this invention is to provide an electrically heated vulcanizing equipment adapted for use in repairing and rebuilding all size tires in present day use, also to provide a vulcanizer embodying flexible vulcanizing pads which will simultaneously heat both inner and outer walls of the tire, and also a bead vulcanizer adapted for close work and vulcanizing around and adjacent the head of the tire casing.

CURTAIN FOR MOTOR VEHICLES.—E. C. FAHRNEY, 124 W. Washington St., Hagerstown, Md. The invention relates to curtains for motor vehicles, and has for its object to provide a curtain adapted to be arranged at the wind



PERSPECTIVE VIEW OF A VEHICLE, WITH CURTAIN IN PLACE

shield to cover the space between the shield and its supports, and between the shield and the body of the vehicle, and between the sections of the shield to prevent the entrance of moisture at the front of the vehicle.

COURSE INDICATOR.—R. WHEELER, Wellsburg, W. Va. The invention relates to a course indicator to be attached to automobiles and all vehicles propelled by steam, gas, or electricity, the objects are to provide means by which the driver can indicate the course to be taken at street corners, cross roads or on crowded thoroughfares, to provide means by which the course can be plainly observed, to provide means by which drivers of automobiles can guard against collisions at street corners, cross roads, etc.

DETACHABLE AUTOMOBILE CATERPILLAR.—E. RIMAILHO, Paris, France. This invention permits of the prompt replacement from any cause of one caterpillar by another on the spot. The invention consists of a caterpillar which is detachable, and in which the motor which actuates it is arranged inside the perimeter of the chain with a view to forming a unit which is at the same time motor, automobile and detachable.

MOTOR LOCK.—F. A. MILLER, Hart Street Road, Vincennes, Ind. The object of this invention is to provide a lock adapted to engage the clutch pedal and hand lever of a motor vehicle to lock the same when not in use, the device being so arranged that it may be swung out of the way when not in use.

CLEAT FOR TRACTOR-WHEELS.—G. SMITH, Westalton, Mo. The invention relates generally to tractors employing wheels having broad flat fellies, and more particularly to a cleat for use therewith, the purpose of which is to secure a better tractive grip, the object being the provision of a quick detachable cleat for use in soft ground to supplement the ordinary highway cleats employed with wheels of this nature.

LUG PLATE.—C. W. GREGORY, R. No. 5, Box 11, Petaluma, Cal. An object of the invention is to provide a plate for anchoring lugs on surfaces of propelling members, such as the rims of wheels or the like of caterpillars. A further object is to provide an inexpensive lug plate having a flanged aperture through which the lug is adapted to protrude, the flanges at the aperture serving as means for securing the lug on the surface of the propelling means.

Designs

DESIGN FOR A POWDER-CAN OR OTHER RECEPTACLE.—C. S. HUMPHREY, care Manhattan Can Co., Bush Terminal Bldg., No. 10 Brooklyn, N. Y.

DESIGN FOR A WATER HEATER.—C. DARGENT, 360 Crescent St., Brooklyn, N. Y.

DESIGN FOR A BADGE OR EMBLEM.—H. HEILBRON, Tulsa, Okla.

TRADEMARK FOR MILLED LUMBER.—R. H. DARNELL, Memphis, Tenn.

DESIGN FOR A TOBACCO BOX.—ELLA F. DE FOREST, 6 Spring Hill Road, Norwalk, Conn.

Swinging a 250-Ton Load

A REMARKABLE demonstration of the lifting power of a new 250-ton electric crane was staged recently in the railroad shops at Cheyenne, Wyo., when this crane lifted a complete locomotive of the Mallet type, weighing 232 tons, and shunted it back and forth over the floor of the shop as though it were only a toy. The crane held the huge locomotive suspended for over two hours, and finally set it back upon the tracks again.

In preparing for this test, two hooks of the crane were looped over a heavy steel bar at the front of the locomotive, and the steel framework of the engine was made fast to this bar by stout steel cables. A similar arrangement was rigged up with the other two hooks of the crane at the rear of the locomotive body. When the signal was given, the forward end of the locomotive was lifted slightly, followed by the rear. Pause was then made, with the engine suspended a few inches off the floor, while a rigid inspection was made of all the members of the crane and its rigging which were under any load. When this had been satisfactorily terminated, another signal started the motors of the crane humming; the steel cables began to crawl through the blocks, and the great engine was lifted quickly and easily to a height of fifteen feet. At this height it was carried about the shop by the crane and at one point held suspended above the head of a smaller engine.

It is rather common practice to test in this way cranes which are to be employed in railroad shops or in other places over railroad tracks where the setting for such a test is to be had. Our cover shows a stunt of this character in process. The test described, however, was conducted with so large a locomotive and upon so powerful a crane that it really deserves chronicling. — *Eugene Ammon.*

New British Trade-Mark Laws

WITH a desire further to encourage and protect traders in Great Britain who have made their goods and productions known under certain well recognized trading words or trade marks, a new British Trade Marks Bill has been introduced and has passed through the House of Commons, under which when it becomes operative, probably in January next, opportunities will be provided for the registration as trade marks under a special class of those words that cannot now be registered, due to the rigid conditions now associated with the user of any invented or new name. The right of registration in this new class will be open to all those trading in Great Britain, residents or foreigners alike, who prove by statutory declaration that their mark has been publicly known and used by them in connection with the particular class of goods that they wish to have protection in, for not less than two years previously in Great Britain. This wider protection will be the means of saving fraudulent trading and the misappropriation of words and trade marks that the public have become fully accustomed to and are accepted and recognized as indicating the origin and ownership of certain manufactures and articles now in general use.

The reconstruction of industries in Great Britain has been made the subject of considerable investigation and long preparation by the Ministry of Reconstruction, and it is satisfactory to note that in connection with the Government proposals that have been embodied in their new Patents and Trade Marks Bills, clearer evidence of a far wider spirit and of a greater desire to foster and aid those making new proposals for the betterment of industries and commercial trading, is shown than has hitherto been fully associated with the old British Patents and Trade Mark Laws.

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Fundamentals in Flying

(*Continued from page 607*)

fast flying aircraft when the suction due to vacuum effect has ripped the fabric from top of planes leaving the under surface whole, proving what can otherwise be shown, that cavitation is greater than thrust and will be still more potent when accentuated.

Reduced to figures, the expedient should mean an average, broadly of $7\frac{1}{2}$ pounds per square inch of blade surfaces added to the traction of aircraft due to one-half vacuum; or $3\frac{3}{4}$ pounds per square inch of blades added to the push or pull due to one-quarter vacuum. Suppose we attained only one-fifteenth of a vacuum in front of screws, what is the increment of gain from hub to tips of say a two-bladed screw like Fig. 6, ten feet long and one foot width of blades? Broadly $120'' \times 12'' \times 1$ lb., or 1,440 pounds added to the thrusting side of any propeller of like dimensions. An obvious offset is the face of the rib which if two inches wide has 240 square inches area to be deducted from the above 1,440-square-inch face area of screw, leaving 1,200 pounds gain. It may be assumed that as cavitation is a power-absorbing factor, its accentuation adds to the power required to drive it. This again is true comparatively. If the vertical side of the rib was $1\frac{1}{4}$ inches the ratio of increased power absorbed would obviously be 1,200 square inches minus 150 square inches still leaving a pretty item of *1,050 pounds* added to the thrust of a propeller 10 feet long and one foot width of blades.

This phenomenon has ever existed and ever will but has not been utilized to best advantage. Who has not been astounded—amazed—that a simple screw-shaped stick running in thin air will do what it does? A philosopher has said the air is solid if you strike it hard enough; and the tips of 10-foot screws running at 2,000 r. p. m. cleave the air at nearly 12 miles a minute or about 700 m. p. h. The answer then is that unusual velocity explains their power; still it is not all thrust but cavitation that explains our amazement. Intensifying it may seemingly deprive the screw of air where it is needed the most. This would be true if the supply came wholly from the front in alinement with its axis, which, again, if true, would deprive our planes of most of their present tractive power. The blast of air in rear of standing machines may rip the coat from your back, and one may see the commotion due to the blast hundreds of feet to the rear; but, is there any evidence of this blast in front of either standing or moving planes? Observations with smoke will show that probably 90 per cent of the air acted on by running screws flows in towards their axis of revolution from all around their periphery. This is demonstratively due to cavitation, and accounts for their superior efficiency over the water propeller due to quickness, compared to "the relatively slow action of the water in closing in behind the moving blade."

The partial vacuums formed by the whirling winds of the cyclones and waterspouts have overturned locomotives and carried weighty objects many miles. Utilize this to the uttermost and the N C planes and the R-34 dirigibles will have ample evidence of the potency of our attenuated atmosphere. There is always the best type of things, and slight variations may be good, but observed practice in this instance has been any type which is why we have slipped and our propellers slip unduly in their functioning for fulcrum on the air.

If the engine is the heart of aircraft the propeller is certainly its muscle and as certainly capable of much higher efficiencies to the betterment of man's latest conquest.

SAMUEL D. MOTT, M. E.

Passaic, N. J.

The Gilboa Dam

(*Continued from page 609*)

long slopes of the earth section will be upheld by a strong retaining wall of masonry. This portion will have a masonry core wall and the upstream face is to be paved with heavy rock. The crest here will be some 20 feet higher than that of the spillway section. When the dam overflows, the water is to be carried off by the natural bed of Schoharie Creek; but a spillway channel is arranged along the face of the eastern half of the entire dam. That is to say, this channel extends westward from the eastern end of the spillway section for much the greater part of the length of that section. The remainder of the section between this terminus of the channel and the retaining wall of the downstream slope of the earthen portion of the dam delivers its water into a narrow groove corresponding to the present bed of the Schoharie. The channel along the face of the eastern half of the dam thus receives along its southern side the greater part of the overflow water from the dam. Because of the foregoing, the water delivered over the dam will be divided into two streams. One at the center of the whole dam and adjacent to the end of the earthen section will flow down the downstream face of the spillway and on in a generally northern direction. This stream will thus correspond to the usual overflow of a dam. The other stream is formed by water coming over nearly the whole of the spillway but its direction is almost at right angles to the other since it flows lengthwise of the spillway. The channel in which it flows is narrow at its eastern end and broad at its western. Naturally, it descends from the one to the other. The total fall is perhaps 100 feet. It conducts the waters which it receives and delivers them into the other stream, the angle of junction being in the neighborhood of 90 degrees.

The downstream face of the spillway is to consist of gigantic steps. The object of these is to break the impact of water flowing over the spillway and tumbling to the discharge stream far below. The service of the dam, of importance to New York City, is the retention of water, not the passage of it onward to the Mohawk. But nature does not furnish her supplies with such regularity that Gilboa Dam with the designed level of its crest will always be equal to the service of impounding them. There will be times of flood—times when great masses of water will flow over the spillway to dash down upon the treads of the big steps, some to continue directly onward along the Schoharie bed, others to be abruptly thrown westward down the channel along the face of the dam and then as abruptly swirled into the northerly current of the other waters. The flow and break of the rushing and tumbling and falling floods of the contending rapids, culminating in the conflict at the junction of the two streams will create a very notable sight. Viewed from an advantageous point on the downstream slope of the earthen section of the dam, the vision of downtumbling water and up-rising spray may be seen at close range.

It will, perhaps, be gathered from the foregoing that the precise manner in which the overflowing water and the complicated construction of dam and channels will react upon each other, could hardly be known in advance. And yet with such a costly structure, such information is very desirable indeed. So what the engineers have done is this. A model of the dam, and spillway channel, have been constructed out in the open, and the behavior of water as it flows over has thus been open to observation and study. In this way the design may be modified in minor matters beforehand and thus brought into closer conformity with the hydraulic conditions.

Some may wonder that Gilboa Dam has been designed so that one-half is an

earthen embankment and one-half a masonry structure. The decision to handle the matter in this way will be better appreciated when the character of the underlying material is understood. On the eastern part of the site, the bed rock is at or near the surface. Such material is of the kind suited to masonry construction where the load is enormously concentrated. On the western part, the material is a very stiff, impervious clay which spreads in every direction. This condition of affairs is suited to support an earthen embankment with its extraordinary width of base.

A representative cross-section of the masonry section shows an almost vertical upstream face. The steps on the downstream face are big fellows with treads of 10 or 20 feet and risers of the same size. The materials entering into the dam are to be of two classes. The stepped face is to be covered with stone masonry. A similar stone covering is to form the upstream face from the crest down to about half-way between top and base. The main body of the dam is to be of cyclopean masonry—that is of rock "plums" set in a matrix of concrete. Just how the contractor will handle the job of combining the two types of masonry remains to be seen. He has the option of building up a stone face for a distance and then using it as a form to hold concrete; or of constructing the cyclopean interior and adding the face subsequently. In this latter case, he is to tie the two together with steel rods.

The earthen embankment will have up- and down-stream slopes of about the same degree of steepness. It will be constructed of compacted material. A core wall of cyclopean masonry will be located in the midst of the general mass and be immediately underneath the southern border of the flat crest. This core wall will be set in a trench in the underlying stratum and will rise above the flow level of the water in the reservoir.

The St. Louis Municipal Docks

(*Continued from page 609*)

respectively, north of the dock site. The dikes start at the river bank and extend out into the river at right angles, terminating on a line with the face of the dock. The spring floods of 1917 and 1918 deposited about 150,000 yards of sand and mud behind the dock site, and the remaining amount is being rapidly filled in by public dumping.

The dikes were built of timber piles from 30 to 60 feet in length, and driven to refusal or a maximum penetration of 20 feet. They were driven at such spacing that they could be drawn together and tied with ½-inch galvanized wire and spiked, forming a cluster of three piles; these clusters were spaced 10 feet on centers and framed together, making a solid dike.

In order to prevent the river from scouring under and washing away the pile dikes, a mattress, consisting of 1-inch boards, was woven and spiked together upon the barge, then pushed off the barge into the river as the mattress advanced in construction. It was held in place by cables to the bank. When entirely completed, the mattress was sunk with riprap to the bed of the river. Each mattress was 80 feet wide and about 200 feet long. Upon and through the mattresses the dike piles were driven. Another similar mattress, 80 feet wide and 1,000 feet long, was made and sunk with riprap on the river bed, parallel with, and extending 10 feet under, the face of the dock. This was in order to prevent the river from cutting under the face of the dock and undermining the foundation.

The electric dock equipment is of special interest. Between the units a space of 22½ feet was left for the installation of large vertical elevators, 18 feet wide and 25 feet long, with a lifting capacity of 15 tons, to enable the handling of package freight and to permit the largest automobile trucks to travel from the street level to the barges, and vice versa.

The elevators are to be operated by motors from a concrete water-proof room directly behind them and 3 feet 8 inches under the dock floor. Automobile trucks can travel over the room to reach the elevator. When the vertical elevators are not in use, steel girders which have been provided can be dropped into place by a moving crane, and plank floors can be placed between them, thus forming a continuous dock floor for the travel of railroad cars or cranes from one unit of the dock to another. A wooden warehouse 60 feet x 128 feet, with a 10-foot platform on three sides, has been constructed 25 feet back of the first unit of the dock for receiving inbound and outbound freight.

This space of 25 feet between the warehouse and the dock was left for the purpose of placing a double railroad track, to enable the handling of freight directly between car and dock without passing through the warehouse. A double track was placed directly back of the warehouse for freight that is to pass through the warehouse or be held for various periods, in order to release cars when barges are not immediately available. These tracks are planked so that wagons and trucks can reach the unloading platforms when the tracks are not in use. Storehouses are to be built some distance back of the warehouses and these will be interconnected by means of overhead conveyors, so that goods left in the warehouses more than four or five days can be cheaply transferred to storage. The handling of miscellaneous package freight and bulk material quickly and economically from warehouse, dock and boat, requires many mechanical and electrical devices to be installed, such as continuous conveyors, electric storage-battery trucks, locomotive and traveling gantry jib cranes, overhead monorail telfers, and overhead wharf cranes. Several electric cranes are in operation upon the dock floor and others are to be installed. The entire length of dock when completed will be 900 feet, which will give St. Louis the most modern river terminal in the United States.

It is claimed that the daily capacity of the dock, now nearly completed, is to be about 2,700 tons, which can be readily increased by extending the docks to the north or south, as increased business may warrant. A part of the docks has already been turned over to the Government, and weekly sailings are being maintained from both St. Louis and New Orleans, affording shippers a 20 per cent reduction in freight rates. The double railroad trestle is at present being built at the dock to enable railroad cars to be switched on the dock floor so as to load and unload directly to and from barges, continuously. This is one of the finest municipal concrete docks in the world.—*F. C. Perkins.*

The Thirty-One Knot British Battleship "Hood"

(*Continued from page 610*)

fact that mechanical gear has been adopted in a drive of this great power proves that the experience with geared turbines, in ships of high power, which the British have gained during the stress of wartime service, has satisfied them that this type of reduction gear is economical and reliable.

But when speed is pushed up into the thirties in a big ship, it means length, and lots of it. We saw that in the 30-knot battle-cruiser "Tiger," which is 700 feet long, and the 32-knot "Renown," which is 789 feet long overall. Hence, we are not surprised to find that the "Hood" is 860 feet long between perpendiculars, or 900 feet overall. The beam is enormous—104 feet—which is greatly in excess even

of any existing battleship. But undoubtedly much of this is to be accounted for by the characteristic bulge, which the British have on all their larger ships as a protection against the torpedo. It is probable, in fact inevitable, that the lines of the ship correspond in fineness to those of the "Courageous" and the "Renown." It is evident that the British, as a result of their war experience, both for strategical and tactical reasons are firm believers in the value of high speed; or does it mean that the Lord Fisher school, also which was responsible for the despatch of the two battle-cruisers that found and sank the *von Spee* armored cruisers, was responsible for giving to a battleship the speed of a battle-cruiser?

Whether the "Hood" is the type that will be followed in the future for capital ships or ships of the line, it is hard to tell; for immediately upon the armistice, orders were given to scrap the "Rodney," "Anson" and "Howe," which were about ten to fifteen per cent completed, and finish only the "Hood," which was from 60 to 70 per cent completed. This was the beginning of a wholesale retrenchment which set the pace for our European allies who are doing no capital ship construction at the present time. This policy of retrenchment was carried to enormous lengths, as may be judged from the fact that the British admiralty has scrapped 156 fighting ships, including all of her pre-dreadnought vessels. And the end is not yet, for one of the battle-cruisers has already been scrapped, and it has been seriously proposed to scrap all of the dreadnoughts previous to the "Orion" class.

We can scarcely credit that this is seriously intended, as it would mean the striking from the list of all the dreadnoughts armed with the 12-inch, or twelve ships in all. The equivalent of this in our own Navy would be the scrapping of our six dreadnoughts of the "Arkansas," "Florida" and "Delaware" classes.

Those of us who saw the "Renown," when she brought the Prince of Wales to this country, will note a general similarity of outline between her and the larger ship. The increase in horse-power has necessitated the use of an additional smokestack, and the additional pair of 15-inch guns called for the installation of a second after turret.

A noticeable feature is the mounting of the range finders above, instead of within the turrets. In our Navy the body of the range finders is mounted within the turrets and only the ends, containing the lenses, project through the turret walls. Why the British have placed theirs entirely in the open is a mystery. A large range finder is mounted above the conning tower, and a smaller one in the director tower at the top of the tripod mast.

Home-Made Road Surfacing Machine

(Continued from page 612)

The machine is designed on the same principle as a carpenter's plane and, of course, has such a bearing on the road surface that it was too much for mules to pull up an incline. It does not take the place of a road machine where heavy grading is desired, but it does cut off the bumps on country roads, fill up hollows and pack the surface.

The tractors have no difficulty in pulling it up a steep grade, according to the inventor. It does not take the place of a plow but furnishes a simple homemade device that does more effective work than a split log drag and costs but little more to make. Many counties and townships have limited funds and cannot afford expensive machinery, and yet have miles of road which, while not impassable, is very uneven and rough to ride over. Many new roads are left to settle and pack after construction and become very uneven. On such roads the planer will do effective work—according to claims.

The stipulations herewith given for constructing the home-made device are not arbitrary and if mules are used instead of tractors the dimensions can be reduced: An old machine blade or tire iron can be used on the third timber. The spikes can be any length over eight inches and will last longer if case-hardened. Old railway ties can be used instead of sawed timbers. One of the planers in use in North Carolina was constructed at a cost of $15, and the maximum expenditure for the device should not exceed $25. Spikes 1¼ inches have given the best results. Any carpenter or blacksmith can make the planer. Its form of construction enables it to span the depression and cut the high spots on the road surface. It only strikes the bumps and waves of the road and does not follow the surface if uneven.

It was designed for rural highways exclusively. Not taking into account the work of the split log drag, little highway improvement has been accomplished for rural sections where funds are limited and mileage excessive.—*S. R. Winters.*

Is Germany Bluffing?

"WE are building a new type of air ship, capable of speeds of 120 miles per hour," announce German airship engineers. As no airship has, up to the present time, reached a higher speed than 65 miles per hour, the question arises . . . is it possible to build ships reaching such tremendous speeds of 120 miles per hour or more? Certainly, the possibility is there, although up to now it has not been employed.

As to size, the ship being intended for passenger work, she will have to displace a great amount of air, or the useful lift will be too small. By useful lift, we understand that part of the total or gross lift, which becomes available for passengers, crew, cargo, and mails. If long-distance journeys are contemplated, the minimum size of ship would seem to be of about 5,000,000 cubic feet capacity.

The useful lift would, in this case, amount to about 30 to 40 tons approximately, according to the length of flight and the amount of fuel carried. Engines having a total of not less than 10,000 horse-power would be required to propel a ship of this size at a speed of 120 miles per hour, and the shape of the hull would have to be the most efficient streamline shape known. This seems enormous, but nature has provided us with a means of cutting down the power needed to one-half.

If, instead of flying at low altitudes of say, a thousand feet, we ascend to 18,000 feet, we find that the air is only half as dense as at sea-level. The horse-power needed varies as the density, so that we now require only 5,000 horse-power to propel our ship at 120 miles per hour. This power could easily be fitted, as we now-a-days have engines of 700 and more horse-power per unit.

Seen in the air, the dirigible would show a perfect streamline body, no cars, etc., would be noticeable outside the hull, as the engines would be fitted inside, to reduce resistance as much as possible. Thin aluminum-alloy sheeting would form the hull cover, and supersede the old-fashioned fabric envelope which has been in use up to now. The resistance due to friction would be cut down considerably, and the nose of the airship could easily be made strong enough to withstand the severe pressure encountered there.

The engines would have to be fitted with superchargers, which pump air into the carbureters and enable the engine to give its full power at high altitudes. The propellers would have adjustable pitch to give the maximum efficiency at high and low altitudes. A high-speed airship of the type sketched here is quite practicable, and the near future will show how far this forecast has been correct.—*C. A. Oldroyd.*

Germination of Grains

FROM time to time statements are seen as to the germination of grains of cereals found wrapped up with ancient Egyptian mummies, and clergymen have been known to use these reports as an evidence, or at least an illustration, of immortality.

Investigation of this matter, through the Department of Agriculture at Washington, has resulted in positive information that such reports of germination are fictitious. Repeated attempts have been made to grow these seeds under the most favorable circumstances, but with entirely negative results. Maspero, the noted Egyptologist offers an explanation of the reputed growth of seeds, in that Egyptian fellahs and sellers of antiques are known to mix recent seeds with these ancient ones for sale to gullible travelers.

In the *Mercuralies Agricoles* of the 10th of April, 1914, the germinating powers of four cereals, wheat, rye, barley and oats, are given for a period of six years. Wheat failed rapidly, so that at the end of three years only 1 per cent germinated, and none after. Rye failed rapidly, and none appeared after the second year. Barley had 1 per cent at the fourth year and none after. Oats 2 per cent the fifth year, none the sixth.

In the same article is a report of tests made by M. Becquerel, in 1906, in which he tested some museum seeds, whose ages were known to extend from 30 to 150 years. Attempts at germination were made under the best possible conditions, but not a single seed sprouted.

The Department furnishes a report, from a German source, of similar tests, but indicating that the seeds had been kept under better conditions so that a large percentage of germination was secured for wheat, barley and oats at the end of eight or ten years; the Department reporter is very positive that few if any of these seeds would have been alive at the end of the second decade.

Further tests have been made of mummy seeds microscopically, and the result has shown that the seeds have deteriorated so as to make germination impossible.—*J. F. Baldwin.*

The Helicopter

INASMUCH as the helicopter is purposely designed to rise straight up and to descend perpendicularly, it would be able to start away from any moderate space, such as a roof, an ordinary street, or the deck of a vessel, and alight upon the same spot on returning from a flight. This would permit the machine to operate under atmospheric conditions and in relation to a terrain which would invite catastrophe in the case of an airplane. The helicopter, with the anticipated deliberate movement in nearing the ground, could maneuver for a favorable landing place, and do this night or day, in fog or snow, and ascend again after getting within a few feet of earth or water, if such a course were essential to safety.

When aloft, the helicopter could hover over a given spot, whereas the airplane, to effect sustentation, must maintain a high rate of speed. By means of suitable rudders or small planes, the helicopter could be directed horizontally and likewise tipped up or down on the longitudinal axis of its fuselage. If inclined a few degrees toward th head the machine should move forward in a horizontal plane, and if similarly tipped by the stern it should move just as fast in that direction. This is because the propellers when canted from the vertical exert both a sustaining and a propelling force.

With all these advantages awaiting the helicopter that will work, there is every reason to encourage the engineers who are bold enough to turn to this rather discredited type o faircraft, and to hope that the conclusion of their experiments may give them as much satisfaction as has the start.


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